Registered at the G.P.O. for Transmission to Canada by Magazine Post.

VOL. 43. Ser. A. Part 5. pp. 129–160. MAY, 1955.

THE REVIEW OF APPLIED ENTOMOLOGY

SERIES A: AGRICULTURAL.

ISSUED BY THE COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

LONDON:
COMMONWEALTH INSTITUTE OF ENTOMOLOGY,
56, QUEEN'S GATE, S.W.7.

Price 4s. net.

All Rights Reserved.

Commonwealth Agricultural Bureaux

EXECUTIVE COUNCIL.

W. F. C. Morton, *Chairman*, Union of South Africa.

J. E. C. Coventry, B.A., M.Sc., *Vice-Chairman*, Federation of Rhodesia and Nyasaland.

W. C. Tame, United Kingdom.

Lieutenant-Colonel J. G. Robertson, B.S.A., F.R.S.A., Canada.

W. Ives, M.Ec., Australia.

V. Armstrong, B.Sc., Ph.D., D.I.C., New Zealand.

P. N. Haksar, Counsellor (External Department) of the High Commissioner for India in the United Kingdom, India.

A. M. Chowdhury, Pakistan.

A. I. Perera, C.B.E. (for H. E. The High Commissioner for Ceylon), Ceylon.

C. E. Lambert, C.M.G., Colonial Territories.

Sir Herbert Howard, *Secretary*, Farnham House, Farnham Royal, nr. Slough, Bucks.

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

Director and Editor.

W. J. Hall, C.M.G., M.C., D.Sc.

Assistant Director.

E. O. Pearson, B.A.

Assistant Editor.

H. S. Bushell, M.A.

Head Office—c/o British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office and Library—56, Queen's Gate, London, S.W.7

THE EAST AFRICAN AGRICULTURAL JOURNAL

OF

Kenya, Tanganyika, Uganda and Zanzibar.

Editor:
Director of East Africa Agricultural Research Institute, Amani, Tanganyika

Editorial Board:
Directors of Agriculture of Kenya, Tanganyika, Uganda, and Zanzibar.

Published Quarterly in July, October, January, April.

Each volume consists of four issues, commencing with July number.

SUBSCRIPTION: Sh. 5/- per volume (including postage).

Subscriptions and all business communications to be addressed to the: GOVERNMENT PRINTER, P.O. Box 128, Nairobi, Kenya.

¶ The current volume 1945-6 is No. XI—All previous numbers are out of stock.

A CRITICAL REVIEW

of the World Literature on

THE LEPIDOPTEROUS STALK BORERS OF TROPICAL GRAMINACEOUS CROPS

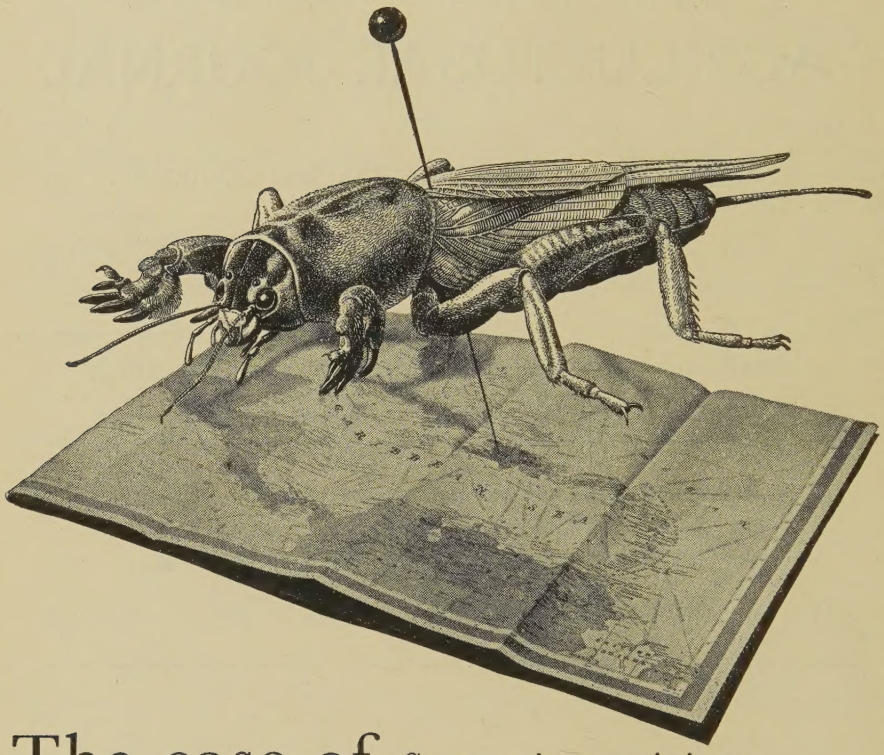
By W. F. JEPSON, O.B.E., Ph.D.

Roy. 8vo. pp. vi and 127. Paper Covers. Price 15s. ($2.25). Post Free.

This comprehensive review is divided into eight sections as follows:—

1. Historical
2. Systematic characters in the identification of the adults
3. Host range of the stalk borers and host-plants of economic importance
4. Bionomics
5. Population estimation and damage assessment
6. Relation of stalk borers to cultural practices
7. Parasites, predators and diseases
8. Control

Conclusions and recommendations for future research are given and a long list of the references mentioned in the text. There is also an index to names of insects and one to names of plants.



The case of *Scapteriscus vicinus* . . .

Wherever the mole cricket burrows, crops are sure to be in trouble. With grotesquely developed forelegs acting as shovel and rake for digging, and as shears for clipping roots, this armoured tunneller works its destructive way through many crops — particularly sweet potatoes and tobacco. Its presence is particularly dreaded in nurseries, where it plays havoc with seedlings.

Caribbean and Central American farmers, who have been losing thousands of dollars to mole crickets each year, now meet and destroy this pest with aldrin. This potent soil insecticide, recently developed by Shell, is the perfect answer to mole crickets and to many other pests that spend much of their lives below ground.

1 to 2 lbs. of aldrin per acre, applied to the soil before planting out, annihilates the heaviest infestations — and one dressing gives at least a year's protection.

Aldrin is fast becoming recognised as being the best of all soil insecticides. Another recently developed Shell insecticide is dieldrin, possessing exceptional persistence. It is extensively used on foliage and also as a residual spray against disease-carrying insects.

Have you a stubborn pest problem to be solved? For further information apply to your Shell Company.

aldrin

aldrin and dieldrin are SHELL insecticides for world-wide use

Issued by The Shell Petroleum Company Limited, London, E.C.3, England.

Bawden (F. C.), Hamlyn (B. M. G.) & Watson (M. A.). **The Distribution of Viruses in different Leaf Tissues and its Influence on Virus Transmission by Aphids.**—*Ann. appl. Biol.* **41** no. 2 pp. 229–239, 14 refs. London, 1954.

The following is largely based on the authors' summary. *Myzus persicae* (Sulz.) has been shown to transmit the virus of henbane mosaic (formerly known as *Hyoscyamus* virus 3) more readily if made to fast before feeding on the infected leaf and allowed to feed on this for a short time only [*cf. R.A.E.*, A **25** 283; **26** 342], and other viruses have been shown to be transmitted similarly. Various explanations have been advanced [*cf.* **26** 343; **28** 301; **40** 187]. Aphids that have fasted seem more likely to imbibe sap initially from epidermal cells than those that have not, and ultra-violet radiation was used to discover whether viruses occur predominantly in these cells. The results showed that irradiating both surfaces of leaves systemically infected with the viruses of cabbage black ring spot or henbane mosaic decreased the infectivity of the expressed sap to about one-fifth. As irradiation probably inactivates virus mainly in the epidermis, which occupies about one quarter of the volume of the leaves, these viruses seem to occur at much higher concentrations in sap from the epidermis than in that from other cells. In contrast to these results, the virus of tobacco mosaic seemed not to occur predominantly in the epidermis.

When fasting examples of *M. persicae* were allowed to feed for short periods on irradiated leaves of turnip infected with the ring-spot virus and then transferred to seedling tobacco, transmission was much reduced, but there was relatively little effect on the proportion that transmitted following long feeding periods on the source of virus, and similar results were obtained with henbane mosaic in tobacco.

These findings support the view that fasting increases transmission by increasing the probability that the Aphids will feed on the epidermis of newly colonised leaves. With longer periods on infected leaves, the ability of fasting Aphids to transmit decreases, probably because they then feed from deeper cells and their stylets contain sap with a lower content of virus. Only virus contained in the stylets seems to be transmitted, and not virus taken into the stomach. About half the transmissions of henbane mosaic by Aphids that have colonised tobacco leaves for hours may be caused by insects that temporarily cease feeding on the phloem and newly penetrate the epidermis.

In subsidiary tests with the viruses of sugar-beet mosaic and beet yellows in sugar beet, irradiation reduced transmission of the former but not of the latter, the Aphid vectors of which become more likely to transmit the longer they feed on infected plants.

Hopf (H. S.). **Studies in the Mode of Action of Insecticides. II. Inhibition of the Acetylesterases of the Locust Nerve Cord by some organic phosphoric Esters.**—*Ann. appl. Biol.* **41** no. 2 pp. 248–260, 10 refs. London, 1954.

The following is virtually the author's summary of the investigations described in this second part of a series [*cf. R.A.E.*, A **40** 272]. Homogenates of the thoracic nervous system of *Locusta migratoria migratorioides* (R. & F.) are able to hydrolyse acetylcholine and o-nitrophenylacetate (NPA), and this hydrolysis can be inhibited by tetraethyl pyrophosphate at approximately the same molar concentration for both substrates. It is possible that one acetylesterase is responsible for the breakdown of the two substances, and there is no reason to assume the existence of a specific

(1814) Wt. P8522/3395 5/55 E.P. Ltd. Gp. 566. [A]

acetylcholinesterase. In normal horse serum, on the other hand, the pseudocholinesterase is quite distinct from the enzyme responsible for the breakdown of NPA.

In an attempt to correlate the inhibition of the locust nerve-cord acetylesterase with toxic activity to insects and mice, four chlorinated diethyl-phenylphosphates were tested as contact poisons against a number of insects and by injection against locusts and mice, and also as *in vitro* inhibitors of locust nerve-cord acetylesterase and horse-serum pseudocholinesterase. The chemicals were the 2-chloro-, 4-chloro-, 2,4-dichloro- and 2,4,5-trichloro- analogues of diethyl-phenylphosphate.

Good correlation exists between their *in vitro* activity against the nerve-cord acetylesterase and their contact activity to Aphids, but not between the former and injection toxicity to locusts. No correlation could be established between the inhibition of horse-serum cholinesterase and injection toxicity to mice. It is thought likely that the inhibition of nerve-cord acetylesterase is of greater importance in Aphids than in other insects, where the toxic action of the phosphoric esters is at least partly concerned with other vital processes, and that a detoxication mechanism in the mammal breaks down some of the phosphoric esters, but not others.

David (W. A. L.) & Gardiner (B. O. C.). **The systemic insecticidal Action of certain Compounds of Fluorine and of Phosphorus on** *Phaedon cochleariae* **Fab.**—*Ann. appl. Biol.* **41** no. 2 pp. 261–270, 3 refs. London, 1954.

The following is mainly the authors' summary. An account is given of greenhouse experiments in which schradan, dimefox (bis(dimethylamino)-fluorophosphine oxide), paraoxon and sodium fluoroacetate were tested against *Phaedon cochleariae* (F.), a useful test insect, on turnip. When these compounds were compared by a dipping technique in which there was direct contact with the insecticide and the insects could also imbibe some of the test solution, or the insects were caged with foliage that had been dipped and then dried, paraoxon was much the most toxic to adults and larvae, the acetate and dimefox were about equally toxic, and schradan was the least so. In all cases, adults were more resistant than larvae.

When the insecticides were applied systemically, either in the nutrient solution or to the compost in which the plants were growing, the order of effectiveness was the same except that the toxicity of the acetate was reduced to that of schradan because it caused the plants to wilt and less of it was absorbed. Both paraoxon and dimefox gave complete kills of adults at practical concentrations (0·01–0·05 per cent.). When the insecticides were applied with a brush to the outer leaves and translocated to the inner untreated leaves, dimefox and paraoxon were toxic to the larvae after repeated applications, but single applications gave very inconsistent results.

It is concluded that schradan and the acetate are ineffective systemically against *Phaedon*. Dimefox and paraoxon are very effective, but because of their high mammalian toxicity, they would require very careful handling in practice.

Jones (G. D. G.) & Connell (J. U.). **Studies of the Toxicity to Worker Honey-Bees (*Apis mellifera* L.) of certain Chemicals used in Plant Protection.**—*Ann. appl. Biol.* **41** no. 2 pp. 271–279, 2 figs., 13 refs. London, 1954.

In the experiments described, nine organic insecticides were tested in various ways for their toxicity to worker honey bees. The bees were mostly

over 13 days old and were kept after treatment at a constant temperature of 30°C. [86°F.] and 55–60 per cent. relative humidity and given sugar solution. Stomach toxicity was tested by feeding measured doses of the chemical in sugar solution to individual hungry bees, and contact toxicity by spraying the bees in a Potter apparatus [*R.A.E.*, A **40** 185]. Mortality was recorded after 24 hours, and the doses required for 20, 50 and 90 per cent. mortality in that time were estimated graphically and are shown in tables. Those for 50 per cent. mortality in mg.x10^{-5} in the stomach tests and (in brackets) in mg.x10^{-5} per sq. cm. in the contact tests were 4 (35·4) for parathion, 6·5 (44·5) for TEPP (tetraethyl pyrophosphate), 7·9 (85·1) for γ BHC (the figure for stomach toxicity being calculated from data obtained in earlier work [**37** 316]), 26·9 (57·5) for dieldrin, 23·9 (56·2) for aldrin, 112·2 (500) for chlordane, 147·8 (512·3) for O,O-diethyl O-2-(ethylmercapto)ethyl thiophosphate (a constituent of Systox), 190·5 (2,317) for dimefox (bis(dimethylamino)fluorophosphine oxide) and 3,981 (4,467) for toxaphene. When the bees were kept for an hour in contact with dry deposits, the mortality percentages in 24 hours were 90 and 75 for 0·09 mmg. dieldrin and aldrin, respectively, per sq. cm., 100 for 0·28 mmg. γ BHC, 90 for 0·54 mmg. parathion, 100 for 3·4 mmg. chlordane, 50 for 10 mmg. of the Systox constituent, 8 for 0·22 mmg. TEPP, 9 for 110 mmg. toxaphene, and 0 for 54 mmg. dimefox, and when the bees were exposed to the vapours from dry deposits, they were 100 for 0·28 mmg. dieldrin per sq. cm., 0·44 mmg. γ BHC, 0·74 mmg. aldrin, 5 mmg. parathion and 3·7 mmg. chlordane and 0 for 70 mmg. toxaphene, 5·5 mmg. TEPP, 18·5 mmg. Systox constituent and 74 mmg. dimefox.

Batt (R. F.), Bennett (S. H.) & Thomas (W. D. E.). **The Absorption, Translocation and Breakdown of Schradan applied to Leaves, using ^{32}P-labelled Material. I. Experimental Techniques.**—*Ann. appl. Biol.* **41** no. 3 pp. 475–483, 6 refs. London, 1954.

Bennett (S. H.) & Thomas (W. D. E.). **II. Evaporation and Absorption.**—*T.c.* pp. 484–500, 1 graph, 9 refs.

Thomas (W. D. E.) & Bennett (S. H.). **III. Translocation and Breakdown.**—*T.c.* pp. 501–519, 1 fig., 16 refs.

The investigations recorded in these parts of a series were carried out in 1950–53. The methods adopted are described in detail in the first of them, the subjects dealt with including the preparation of the solutions of radioactive schradan, the methods of propagating the plants, which comprised apple stocks and seedlings, chrysanthemums, *Coleus*, broad beans (*Vicia faba*) and runner beans, a method of dipping the leaves without contaminating the stem, the performance of the spray gun used to apply atomised sprays, the maintenance of the sprayed plants, the construction of an airflow apparatus for investigating the effect of air changes on evaporation rates, the leaching of treated leaves, plant extraction, and the methods used for making radioassays and estimating schradan decomposition.

The following is substantially the authors' summary of the second part. When ^{32}P-labelled schradan was sprayed on to the leaves of experimental plants of each sort, some was absorbed, some evaporated and the rest remained for a considerable time on the leaf surface as a residue removable by aqueous leaching. Absorbed material is defined as that present on or in the plant and not removable by leaching at the time of examination. Losses due to evaporation from glass slides were lower than expected theoretically and those from leaves were much lower. It is possible that some breakdown of the schradan occurs within the cuticular layer. Comparisons of the

absorption rates of upper and lower surfaces of leaves supported the theory that absorption proceeds through the cuticle rather than by entry of vapour through the stomata. Temperature and light had important effects on absorption, an increase in temperature and exposure to daylight increasing it in broad beans. Young leaves were generally more absorptive than older ones. There were also differences in the absorptive capacity of the different plant species, but such data must be accepted with caution, as, although physical conditions were the same for all the plants, their physiological stages of development were not strictly comparable.

The following is based on the authors' summary of the third part. Tests with experimental plants of each sort showed that light is important in promoting the translocation of schradan from sprayed or dipped leaves. The main direction of translocation was upwards, but some schradan travelled downwards. In apple, translocation took place mainly in the phloem, but some may occur in xylem, particularly in an upward direction. The ratio of translocated to absorbed schradan was about 1 per cent. per day in beans, *Coleus* and chrysanthemums and up to 4 per cent. per day in apple. The breakdown of schradan into substances not extractable with chloroform varied between the plant species, and was far greater in beans than in *Coleus*. In chrysanthemum and apple, the breakdown appeared similar throughout the plant, whereas in broad beans and possibly *Coleus*, it was greater in the untreated sections. The concentrations of schradan that gave about 80 per cent. mortality were found to be 10–15 mmg. per gm. fresh weight of plant tissue for *Aphis fabae* Scop. [*cf. R.A.E.*, A **39** 428], 20–25 for *Macrosiphum* (*Macrosiphoniella*) *sanborni* Gill. and 20–30 for *Aphis pomi* Deg.

Ibbotson (A.) & Edwards (C. A. T.). **The Biology and Control of *Otiorrhynchus clavipes* Bonsd. (Rhyn. Coleop.), a Pest of Strawberries.** —*Ann. appl. Biol.* **41** no. 3 pp. 520–535, 1 pl., 5 figs., 7 refs. London, 1954.

The following is based on the authors' summary. *Otiorrhynchus clavipes* (Bonsd.), all stages of which are briefly described, is a serious pest of strawberries near Cheddar, Somerset. The adults nibble the foliage, and the larvae eat the roots of the plants and burrow into the rootstocks.

Observations on the bionomics of the weevil showed that the adults appear in two waves, some individuals pupating in autumn and emerging within a brief period in spring, and others pupating in late spring and summer and emerging in succession between mid-June and the end of August. They feed voraciously and pairing is alternated with egg-laying, the females laying 100–300 eggs each in the upper soil layer. About one egg is laid for every 10 sq. mm. of leaf consumed. Both fertilised and unfertilised females oviposit, the eggs being equally viable, and the egg stage lasts 17–24 days. The larvae burrow rapidly into the soil, are guided to their food by the exudates from the strawberry roots, and move from plant to plant remaining within the range of the roots while feeding. When full-fed, they move to greater depths and eventually pupate in smooth earthen cells 6–8 ins. below the plants.

Damage to the leaves by the adults is unimportant, but that by the larvae to the roots is severe and has been largely responsible for restricting the effective life of the strawberry beds to at most two years. Although attack can be avoided by growing the crop in a one-year rotation, control is difficult because of the intensive cropping practised, which creates very suitable conditions for the spread of infestation. In tests, the adults were killed by dusting the soil with 10 per cent. DDT, and watering the plants

with liquid preparations of DDT or BHC or injecting DD (a mixture of dichloropropane and dichloropropene) into the soil effectively controlled the larvae.

Muldrew (J. A.). **The natural Immunity of the Larch Sawfly** (*Pristiphora erichsonii* (**Htg.**)) **to the introduced Parasite** *Mesoleius tenthredinis* **Morley, in Manitoba and Saskatchewan.**—*Canad. J. Zool.* **31** no. 4 pp. 313–332, 3 graphs, 31 refs. Ottawa, 1953.

The following is almost entirely the author's abstract. By 1945, it was suspected that the larch sawfly, *Pristiphora erichsonii* (Htg.), in Saskatchewan and Manitoba had developed an immunity to the introduced parasite, *Mesoleius aulicus* (Grav.) (*tenthredinis* Morl.) [*cf. R.A.E.*, A **37** 271, 442]. The results of the studies here described showed that the embryonic development of *M. aulicus* in sawfly larvae from Manitoba and Saskatchewan is inhibited 3–4 days after oviposition [*cf.* **39** 435]. No such inhibition occurred in larvae from British Columbia, where the parasite is still highly effective. Inhibition seemed to be related to the deposition of phagocytic capsules round parasite embryos, which occurred in host larvae from Manitoba and Saskatchewan, but not in larvae from British Columbia. Encapsulated parasite embryos were shown to be viable, for a number of them hatched after being placed in Ringer's solution. Viability decreased with age. Some embryos were viable seven months after oviposition, though the normal incubation period is 7–10 days. In Ringer's solution, unencapsulated embryos developed more rapidly than encapsulated embryos.

Bradley (R. H. E.) & Rideout (D. W.). **Comparative Transmission of Potato Virus Y by four Aphid Species that infest Potato.**—*Canad. J. Zool.* **31** no. 4 pp. 333–341, 2 graphs, 10 refs. Ottawa, 1953.

The feeding behaviour of *Myzus persicae* (Sulz.), *Aphis rhamni* Boy. (*abbreviata* Patch), *Macrosiphum solanifolii* (Ashm.), and, in limited experiments, *M.* (*Myzus*) *solani* (Kalt.), the four Aphids that infest potatoes in eastern Canada, was investigated in the laboratory in relation to their efficiency as vectors of potato virus Y. Aphids that had been starved for 1–4 hours were placed singly on infected tobacco plants, where each was watched with a hand lens until it touched the plant with its proboscis, and the time during which the proboscis remained in contact with the plant was recorded. The Aphid was then transferred to a healthy tobacco plant and the observation repeated. After completion of the initial puncture on this, it was transferred to a second healthy plant and left for 24 hours. The duration of the feeding contacts was similar in all four Aphids. For *Myzus persicae*, *A. rhamni* and *Macrosiphum solanifolii*, 70 per cent. of the contacts on the infected plant and about 50 per cent. of those on the first healthy plant occupied less than 30 seconds, and 50 and about 20 per cent., respectively, lasted more than a minute. The duration of contact on the infected plant did not appear to influence that on the healthy one. The percentages of Aphids that transmitted the virus were 74 for *Myzus persicae*, about 40 for *A. rhamni* and about 10 for *Macrosiphum solanifolii* when the contacts with the infected plant lasted 5–15 seconds, and about 80, 50 and 20, respectively, when they lasted 16–30 seconds. All three species infected the first healthy plant during feeding contacts of less than 15 seconds, the order of effectiveness being the same as before, but the percentage of transmission increased with duration up to 31–60 seconds. The average percentages of these plants infected were 55, 31 and 9 for the three species,

respectively, and 4 for *M. solani*. Of the Aphids that infected either plant, 72 per cent. of *Myzus persicae*, 69 per cent. of *A. rhamni* and 52 per cent. of *Macrosiphum solanifolii* infected the first and 77, 54 and 72 per cent., respectively, the second about 50 per cent. of the first species and 25 per cent. of each of the other two infected both plants. In another experiment in which 50 single Aphids were transferred after one feeding puncture on an infected plant to five successive healthy ones at five-minute intervals, 41 of *Myzus persicae* and 18 of *A. rhamni* transmitted the virus. Of these, 34, 37, 17, 10 and two per cent. of *M. persicae* infected 1, 2, 3, 4 and 5 plants, respectively, and 66 and 33 per cent. of *A. rhamni* infected one and two. In general, the feeding behaviour of the four Aphids was similar, but *Macrosiphum solanifolii* and *M. solani*, unlike the other two, did not begin to feed as soon as they were placed on a plant and were not induced to do so by increasing the period of fasting.

It is pointed out that in order to prevent winged vectors from introducing the virus into a crop, insecticides must kill the migrants soon after they alight and before they feed. Spread may be increased if the insecticide causes the Aphid to move from plant to plant while attempting to feed.

Arthur (A. P.) & Coppel (H. C.). **Studies on Dipterous Parasites of the Spruce Budworm, *Choristoneura fumiferana* (Clem.) (Lepidoptera: Tortricidae). I. *Sarcophaga aldrichi* Park. (Diptera: Sarcophagidae).** —*Canad. J. Zool.* **31** no. 4 pp. 374–391, 1 pl., 18 figs., 28 refs. Ottawa, 1953.

Maw (M. G.) & Coppel (H. C.). **II. *Phryxe pecosensis* (Tns.) (Diptera: Tachinidae).**—*T.c.* pp. 392–403, 18 figs., 9 refs.

Data on the natural enemies of the spruce budworm, *Choristoneura fumiferana* (Clem.), in Canada [*cf. R.A.E.*, A **38** 100] indicate that Dipterous parasites are about as important as Hymenoptera, though only half as numerous. Laboratory studies were begun in British Columbia in 1943 with a view to providing means of identification for their various stages, and an account of the method of rearing the parasites from field-collected hosts is given in the first of these two parts of a series dealing with the results, together with descriptions of the immature stages and reproductive system of *Sarcophaga aldrichi* Parker and information on its bionomics [*cf.* **27** 646]. This species, which was reared from *C. fumiferana* in small numbers each year since 1947, is commoner as a parasite of *Malacosoma disstria* Hb., and has also been recorded from *Lymantria dispar* (L.) and *Stilpnotia salicis* (L.). It was reared in the laboratory from larvae deposited by the ovoviviparous females on a medium of pork liver alone or mixed with fish. The larvae became full-fed in 5–8 days, and the puparia were formed after a further 7–44 days. A period of diapause, which normally lasted through the winter, was necessary for adult emergence; the latter began 11 days after the puparia had been transferred from cold storage to a constant temperature of 21°C. [69·8°F.] and 60 per cent. relative humidity and continued for six days, males emerging about two days before females. Males survived for 46 days and fertilised and unfertilised females for 23–119 and 67 days, respectively. Reproduction began 21–30 days after emergence and continued intermittently throughout life; an average of 13·7 larvae and 16·6 eggs was deposited per female. Only one generation developed each year.

The second paper deals in a similar manner with *Zenillia* (*Phryxe*) *pecosensis* (Tns.), a native parasite that was obtained consistently from *C. fumiferana* in British Columbia. It was reared in the laboratory at 23°C. [73·4°F.] and 60 per cent. relative humidity in larvae of *Pieris rapae* (L.),

since *C. fumiferana* was not available. The preoviposition and oviposition periods lasted 7–14 and 3–9 days, respectively. The eggs, which were usually laid on the lateral thoracic region of the host, hatched within six hours if deposited on the second or third day of oviposition, within 20–30 minutes if deposited on the fifth day, and within ten minutes if on the sixth—eighth. The combined egg and larval stages lasted 7–11 days, puparium formation was completed 24 hours later, and the adults emerged after a further 9–11 days. The adults survived for up to 53 days, and the females deposited a total of 1–32 eggs each. As many as five parasite larvae were found in a single host, but not more than three completed their development. During the first and second instars, the parasite larvae occurred in the body cavity of the thoracic region of the host, and during the third instar, they occupied a funnel-like structure attached to one of its tracheae.

MELIS (A.). **Nuove osservazioni sui costumi della mosca delle olive** (*Dacus oleae* **Gmel.) nella Toscana litoranea, con particolare riferimento agli sfarfallamenti invernali e primaverili.** [New Observations on the Habits of *D. oleae* on the Coast of Tuscany, with particular Reference to the Emergence of Adults in Winter and Spring.]—*Redia* **38** pp. 1–84, 2 pls., 11 figs., 3 fldg. tables, 16 refs. Florence, 1953. (With a Summary in English.)

Studies were begun on the coast of Tuscany in 1949–50 to ascertain whether the adults of *Dacus oleae* (Gmel.) that result from larvae that pupate at the end of the year survive long enough to oviposit in the young olives at the end of June, which is the time at which infestation begins. In that season, pupae were collected at the end of November and buried in special emergence cages in the soil, but only 12·9 per cent. gave rise to adults by the end of March, and hardly any between then and June. The more detailed observations here described were carried out in the next two seasons. Since it was thought that the low percentage of emergence might have been due to some unfavourable condition for the pupae, the tests in 1950–51 were begun with larvae collected in November and allowed to enter the soil in the cages and pupate under natural conditions. Nevertheless, only 11·65 per cent. gave rise to adults, and these emerged between January and the first few days of April. In the following year, both larvae and pupae were used, and only 7·1 and 2·6 per cent., respectively, gave rise to adults, these appearing between December and early April. With two exceptions, none of the adults that emerged in these years survived for more than a month in the laboratory under conditions resembling those in the field, though some survived for four months or more at 20°C. [68°F.] and 80 per cent. relative humidity. A few adults were taken between November and April in bait-pans containing 5 per cent. diammonium phosphate hung in the olive trees from November to June, but none between April and the beginning of infestation in June and July [*cf. R.A.E.*, A **42** 37]. The effect on adult emergence of temperature, rainfall, the chemical composition of the soil and the oil-content of the olives in which the various generations of *D. oleae* develop is discussed.

It thus appeared unlikely that the adults that emerge in winter or early spring survive to oviposit in summer. Lupo considered that the flies migrate from the mountains to the coast in southern Italy [*cf.* **35** 379], but it is not known whether similar migrations occur in Tuscany. Small numbers of larvae may overwinter in fruits on the few wild olive trees in the area and give rise to adults from May onwards, but this would not account for the large numbers taken throughout the olive-growing area in June.

Melis (A.). **Esperienze di lotta contro la mosca delle olive** (*Dacus oleae* **Gml.) nella Toscana litoranea nel 1952.** [Experiments on the Control of *D. oleae* on the Coast of Tuscany in 1952.]—*Redia* **38** pp. 111–143, 2 figs., 10 refs. Florence, 1953. (With a Summary in English.)

Large-scale experiments on the control of *Dacus oleae* (Gmel.) were continued on two varieties of olive on the coast of Tuscany in 1952 [*cf. R.A.E.*, A **42** 112, etc.], when punctured olives were first found in early July, the infestation followed its normal course, and treatments were tested in four separate olive-growing areas.

In the first of these, the Berlese bait-spray of sodium arsenite and molasses [*cf.* **41** 393] was applied to 45,000 trees, according to the usual method, six times between 11th July and 24th October, and the percentages of fruits infested by mid-September and mid-October were 9·9–37 and 25–60, respectively, as compared with 55–69 and 100 for no treatment. In the second, sprays of 2 and 3 per cent. of a solid product containing 50 per cent. technical DDT that was crushed and melted before being added to the water, and of 2 and 3 per cent. of an emulsion concentrate also containing 50 per cent. technical DDT, were applied to lots of 200 trees four times between 8th July and 9th October. The infestation percentages were 23–97 and 2–43 for the two products, respectively, in mid-September, and 82–100 and 93–100 in mid-October, as compared with 98–100 per cent. on both dates for no treatment, the higher concentrations not always giving the best results. However, though many of the infested fruits on the untreated trees showed one or more emergence holes, the proportion of such fruits on the treated trees was very low. Lots of 6,000 trees in the same area were treated with the Berlese bait-spray and one suggested by Bertelli. This consisted of a mixture of 84 lb. molasses, 4·2 lb. sodium arsenite and 1·18 gals. water, diluted 7:95 by weight, so that the content of sodium arsenite was almost the same as in the Berlese mixture. Both were applied six times between 7th July and 16th October, and the percentages of fruits infested were 12–13 and 10·5–31, respectively, by mid-September, as compared with 52–85·8 and 59 for no treatment, and 37–41 and 28–31 in mid-October, as compared with 100.

In the third area, parathion at 0·09 per cent. in a wettable-powder spray and 4 per cent. in a dust was applied on 1st–2nd and 23rd–24th September and 10th–11th October to lots of 150 trees. The infestation percentages in mid-September were similar to those on untreated trees, and though the dust did not prevent complete infestation of the fruits by mid-October, the spray checked subsequent attack, so that the final infestation was 18–23 per cent., as compared with 82–86. Both preparations reduced the proportion of olives showing exit holes. The De Cillis bait-spray, stated to consist of 5 per cent. technical sodium orthoarsenite, 5 per cent. adhesives and attractants, 50 per cent. grape juice and 40 per cent. sugar, diluted to 5 per cent. by weight in water, and thus containing 0·25 per cent. sodium arsenite [*cf.* **42** 359], was applied to 20,000 trees according to the Berlese technique six times between 10th July and 19th October, and reduced the percentage of fruits infested from 78·5–91 to 4·1–8 by mid-September and from 100 to 13–22 by mid-October. When parathion was applied at 0·09 per cent. in a spray on 20th September and 7th October to small numbers of trees previously sprayed with the De Cillis mixture, the percentages of fruits infested by mid-October were 41–47, as compared with 82–86 for no treatment.

In the fourth area, the Berlese spray was applied to 65,000 trees six times between 28th July and 14th October and reduced the percentages of fruits infested to 0–13 in mid-September and 7–31 in mid-October, as

compared with 36–68 and 97–100 for no treatment. Another 5,000 trees were treated with a bait-spray (Petrosini mixture) of molasses, sodium arsenite, attractants for the males or females, and unspecified substances that prevented the deposits from drying (41 : 3 : 1 : 5 by weight), applied six times between early July and mid-October in the same way as the Berlese sprays. In mid-September and mid-October, the percentages of infested fruits were 5–8 and 11–12, respectively, as compared with 27 and 41 for no treatment.

The yield of oil from trees treated with any of the sodium-arsenite bait-sprays was much higher than that from the untreated trees, and its acidity was lower. It is recommended that the Berlese spray should be applied at the end of June or beginning of July, about 20th July, in mid-August and mid-September, about 10th October, and at the end of October or beginning of November, the treatment of a whole district being completed within 2–3 days and repeated if followed by rain. Unusually severe outbreaks can be controlled by sprays of parathion.

Zocchi (R.). **Una eccezionale infestazione di *Coroebus fasciatus* Villers in Toscana.** [Unusual Infestation by *Coraebus fasciatus* in Tuscany.]—*Redia* **38** pp. 163–168, 4 figs., 1 ref. Florence, 1953. (With a Summary in English.)

Infestation of oak trees by the Buprestid, *Coraebus fasciatus* (Vill.), the larva, pupa and adult of which are briefly described, has become widespread on the coast of Tuscany in recent years. The adults usually appear at the end of June or during the first fortnight of July, and the fertilised females lay their eggs singly on the young twigs. The larva enters the twig on hatching and bores an irregular gallery downwards in the wood. The gallery may extend for as long as 5 ft. Activity ceases in October and is continued in spring, when the larva circles the pith and finally enters it. It overwinters again and pupates in the following spring, in a cell just below the surface of the tree.

The species of oak most commonly attacked are *Quercus suber* and *Q. ilex*, and infested trees can be recognised by the die-back of the branches caused by the interruption in the flow of sap. The only satisfactory control measure is the removal of affected branches in May; they should be caged for the possible emergence of parasites or else destroyed.

Zocchi (R.). **Segnalazione di alcuni centri di infestazione termitica in Toscana.** [Records of some Centres of Infestation by Termites in Tuscany.]—*Redia* **38** pp. 195–202, 1 pl., 4 figs. Florence, 1953. (With a Summary in English.)

Records are given of injury to structural timbers in a few buildings in Tuscany by *Reticulitermes lucifugus* (Rossi) and to various ornamental trees by this termite and *Kalotermes* (*Calotermes*) *flavicollis* (F.).

Melis (A.) & Marinari (A.). **Esperienze di lotta contro il Cleono della bietola** (*Temnorrhinus mendicus* **Gyll.) nel 1953.** [Experiments on the Control of *Cleonus mendicus* in 1953.]—*Redia* **38** pp. 203–224, 4 figs., 1 ref. Florence, 1953. (With a Summary in English.)

Experiments on the control of *Cleonus* (*Temnorrhinus*) *mendicus* (Gylh.) on beet in the Province of Livorno, Italy [*cf. R.A.E.*, A **42** 113] were continued in 1953. Sprays of heptachlor, lead arsenate and BHC were

applied on 13th April, when the plants had 2–3 leaves, and again on 20th and 28th April and 16th May, and the condition of the roots was assessed on 31st July or 1st August. Heptachlor was applied in a wettable-powder spray at 0·1 per cent. on the first date, when it caused some mortality of adults in 24 hours, and at 0·075 per cent. on the other three, when mortality in 24 hours was fairly high. The percentage of roots undamaged was about 54, as compared with 32 for no treatment. Lead arsenate was applied at 1 per cent. and caused some mortality after each application, and the percentage of roots undamaged was 16·5, as compared with none in the controls. A wettable powder containing 16 per cent. pure γ BHC was applied at 0·4 per cent. throughout, and two emulsion concentrates and two wettable powders each containing 16 per cent. γ BHC in the technical product were applied at 0·4 per cent. on the first date and at 0·3 per cent. on the other three. Dead or paralysed adults were found 12–24 hours after each application, and the percentages of roots undamaged were 48·7 for the product containing pure γ BHC, as compared with 7·7 for no treatment, and 34·4–48 for the other materials, as compared with 11·9–62·8.

In further tests, a dust containing 6 per cent. aldrin was applied with a fertiliser to the soil at 0·45 lb. toxicant per acre and incorporated to a depth of 6–8 ins. at the time of sowing, on 21st April, and this was followed on 5th and 15th May by applications of a wettable-powder spray of 0·1 and 0·14 per cent. dieldrin. Dead adults were found under clods 10–15 days after the aldrin treatment, and dead and paralysed adults were observed 1–9 days after spraying with dieldrin. Adults placed on leaves sprayed with dieldrin 13 days previously all died in 2–3 days. The roots were examined on 11th–12th September, and the percentage undamaged was 65, as compared with 59 for no treatment. The aldrin dust was applied to the soil at the time of sowing in a late-sown plot on 25th May at 1·62 lb. toxicant per acre, and dead adults were observed a few days later. This treatment retained its effectiveness for some weeks, and 69·5 per cent. of the roots were undamaged on 11th–12th September.

Observations on the bionomics of the weevil showed that the overwintered adults appeared about 20th March. Pairing began about 25th March, and oviposition about 10th April. The population increased during April, and though treatments during that month gave considerable control, there was some reinfestation from untreated plots. Larvae about to pupate were found on 20th June, and adults emerged about 15th August from pupae taken to the laboratory. Other insects observed attacking the crop are recorded.

Ciampolini (M.) & Antonelli (C.). **Prime osservazioni biologiche sul *Temnorrhinus mendicus* Gyll. nell'Italia settentrionale.** [First Observations on the Bionomics of *Cleonus mendicus* in northern Italy.]—*Redia* **38** pp. 230–237, 1 pl., 1 fig., 1 ref. Florence, 1953. (With a Summary in English.)

Infestation of beet by *Cleonus* (*Temnorrhinus*) *mendicus* (Gylh.), which had previously been confined to west-central and southern districts of Italy, was reported on sugar-beet near Ravenna in 1949 and had spread within five years over a considerable part of Emilia. Observations on its bionomics were made near Ferrara in 1953. Beet is usually followed by wheat in this area, and the overwintered adults first appeared in the wheat fields at the beginning of March. Those that appeared early remained on the wheat for 20–30 days without feeding and then migrated to neighbouring fields in which beet was germinating, where they fed for 15–20 days before pairing.

Damage to the seedlings was first observed at the end of March and the beginning of April. Adults continued to appear until June and July, and migration to the beet fields was intensified during periods of high temperature. The eggs were laid near the plants, just below the surface of the soil. Adults kept in the laboratory were observed to pair repeatedly from early April to early October, and though the number of eggs laid per female was not determined, some individuals laid 20–30 each in September, so that it seems probable that considerably more than the 60–70 recorded by Menozzi [*cf. R.A.E.*, A **18** 561] were laid during the season. The larvae hatched in 8–10 days and attacked the roots, as many as 30–40 being found on one plant. They pupated in earthen cells, and the adults emerged after 15–20 days, fed on the leaves, and overwintered without pairing. Although newly hatched larvae were found even in October, there appeared to be only one generation a year.

The only parasite observed was the Tachinid, *Rondania cucullata* R.-D. [*cf.* **29** 316, etc.], which parasitised up to 1 per cent. of the adults taken in March–June.

Zocchi (R.). **Note biologiche sulla** *Theresimima ampelophaga* **Bayle-Barelle.** [Notes on the Bionomics of *T. ampelophaga.*]—*Redia* **38** pp. 238–246, 4 figs., 7 refs. Florence, 1953. (With a Summary in English.)

Theresimima ampelophaga (Bayle), which had almost disappeared from Italy [*cf. R.A.E.*, A **28** 454], caused severe damage to vines on the island of Elba in 1952–53 and in the Provinces of Pisa and Siena, on the Italian mainland, in 1953. Observations on the bionomics of this Zygaenid near Florence showed that the adults emerged in June and paired 3–4 days later. The eggs were usually laid in groups of about 50 on the lower surfaces of the leaves, females laying 200–300 eggs each, and the larvae hatched in 7–12 days and fed on the leaves. Between the end of July and mid-September, they moved to the top of the new shoots or to the spurs left after winter pruning and entered the pith, where they overwintered. In the following spring, they attacked the buds and young shoots. When full-fed, about the end of May, they pupated in cracks in the stems of the vines or in the supports, and the adults emerged 2–3 weeks later. There was only one generation a year. The pupae were parasitised by an unidentified species of *Dibrachys* in Elba, and the eggs were destroyed by the mite, *Allothrombium fuliginosum* Hermann, in almost all the areas of infestation. The control measures recommended include the completion of winter pruning and the destruction of the prunings by the end of February to eliminate the overwintering larvae, and the substitution of metal and cement supports for wooden posts as props for the vines.

Pegazzano (F.). **Contributo alla conoscenza della** *Pseudaonidia paeoniae* **Ckll. (Hemiptera, Coccidae, Diaspinae).** [A Contribution to Knowledge of *P. paeoniae.*]—*Redia* **38** pp. 281–315, 19 figs., 12 refs. Florence, 1953. (With a Summary in English.)

Pseudaonidia paeoniae (Ckll.), all stages of which are described, was first recorded from Italy in 1949 [*cf. R.A.E.*, A **41** 108]. Observations in nurseries and gardens near Florence showed that the only plants infested were *Camellia japonica*, azalea and *Rhododendron* sp. and that it had only one generation a year. Oviposition usually began in the first ten days of May, the females laying 180–200 eggs each in 10–15 days. The crawlers

hatched in about ten days and became fixed in a short time on all aerial parts of the plants except the flowers. Adult females were first observed towards the end of July, and adult males appeared in mid-August and fertilised the females, which overwintered. Infestation resulted in withering and sometimes death of the plants within 1–2 years. Good results were obtained by scraping the dead scales from the stems and twigs and applying a spray of 2 per cent. summer oil between mid-June and mid-July, when only immature stages were present.

Fjelddalen (J.). **Rotsnutebille på jordbaer** (*Otiorrhynchus ovatus* **L.**). [A Root Weevil, *O. ovatus*, on Strawberry.]—*Frukt og Baer* **6** pp. 65–75, 9 figs., 16 refs. Oslo, 1953. (Reprint, [13] pp., has a Summary in English.)

Otiorrhynchus ovatus (L.) was observed attacking strawberry in 1939 for the first time in Norway. No infestation was reported in 1940–46, but attack was severe in southern districts in 1947 and subsequent years. Conifers grown in nurseries, especially spruce, were also injured. All stages of the weevil are briefly described, and an account is given of observations in 1948–52 on its bionomics and control.

The females deposited their eggs in or on the soil near the plants in spring and early summer. The larvae hatched in 2–3 weeks, in July–August, and fed on the underground parts of the strawberry plants, overwintering at depths of 6–10 ins. and feeding again in spring until they pupated in June–July. The pupal stage lasted about three weeks, and the adults usually overwintered before ovipositing. Injury was most severe on second- and third-year plants.

Poison baits or insecticides cannot be used for control of the adults as soon as they emerge, since the berries are ripening at that time, and several dusts and sprays applied against them after picking or in early spring gave unsatisfactory results, probably because of migration. Good control was given by watering the plants in May with insecticides in emulsion form, the percentage reductions in the numbers of overwintered larvae after 11 days being 100 for 0·15 per cent. of a concentrate containing 16 per cent. γ BHC or 0·2 per cent. of one containing 70 per cent. chlordane, 98·5 for 1 per cent. of a mixture of 2·1 per cent. BHC, 4 per cent. azobenzene and 0·3 per cent. parathion, and 93·9 for 0·04 per cent. of a preparation containing 35 per cent. parathion. None of these products affected the flavour of the berries.

Fjelddalen (J.). **Gallmygg og gallmidd på frukt og baer.** [Gall-midges and Gall-mites on Fruits and Berries.]—*Frukt og Baer* **7** pp. 37–48, 10 figs., 16 refs. Oslo, 1954. (Reprint (15 pp.) has a Summary in English, pp. 12–15.)

Notes are given on the bionomics, importance and control of several Cecidomyiids and Eriophyids that are not well-known in the literature as pests of fruit trees and soft fruits in Norway. The principal Cecidomyiids are *Dasyneura tetensi* (Rübs.), which has been observed on black currant there since 1948 and became widespread in 1953, and *D. pyri* (Bch.), which attacks pear and has occurred since 1950. The first has 2–3 generations a year, and the second three generations. Both are most troublesome in nurseries. A spray of parathion applied twice at an interval of ten days in May, when the symptoms of infestation first appear on the leaves, is

recommended for control. Raspberry is attacked by *Lasioptera rubi* Heeg., and pear also by *Contarinia pyrivora* (Ril.).

The chief Eriophyids are *Phyllocoptes* (*Eriophyes*) *gracilis* (Nal.) on raspberry and *Eriophyes similis* (Nal.) and *Vasates* (*Phyllocoptes*) *fockeui* (Nal. & Trt.) on plum, all three of which have increased in abundance of recent years. All infest the leaves of their food-plants, and *E. similis* also the fruits, and heavy infestations lead to malformations of various sorts. Parathion sprays give effective control. Other species present are *Cecidophyes* (*Eriophyes*) *ribis* (Westw.) on black currant, *E. pyri* (Pgst.) on pear, *V.* (*P.*) *schlechtendali* (Nal.) and *E. malinus* (Nal.) on apple, and *Phytoptus* (*E.*) *avellanae* Nal. on hazel [*Corylus avellana*].

Ossiannilsson (F.). **En för Sverige ny virusspridande bladlus.** [A Virus-transmitting Aphid new to Sweden.]—*Växtskyddsnotiser* 1953 no. 3 p. 44. Stockholm, 1953.

An apterous example of *Myzus* (*Rhopalomyzus*) *ascalonicus* Doncaster, which had not previously been recorded in Sweden, was observed on chrysanthemum in a glasshouse there in April 1952. The bionomics of this Aphid are very briefly reviewed [*cf. R.A.E.*, A **35** 205].

Borg (Å.). **Dådraviveln, ny som skadedjur i Sverige.** [*Ceuthorrhynchus syrites*, new as a Pest in Sweden.]—*Växtskyddsnotiser* 1953 no. 4 pp. 49–52, 2 figs. Stockholm, 1953.

Camelina sativa grown experimentally in Sweden in 1952 [*cf. R.A.E.*, A **41** 127] was attacked by weevil larvae of the genus *Ceuthorrhynchus*, which destroyed the seeds. The attack recurred in 1953, and the weevil was identified as *C. syrites* Germ., which has been recorded from this plant in Russia [*cf.* **19** 386; **26** 257] and Germany. Ovipositing females were seen at the end of June, and larvae were observed in the pods in mid-July. The loss of seed amounted to about 20 per cent. on a late variety, but an early one was not attacked.

According to Madel (1950), this weevil caused serious injury to *Camelina sativa* near Freiburg in Germany in 1947–48. The overwintered adults appeared in May and fed on the young plants, causing slight damage. Oviposition occurred at the end of the flowering period, one egg being laid per pod. The pods contain about 12 seeds each, of which the larva destroys 8–10 before becoming full-fed. Pupation occurs in the soil, and adults were seen in September–October, though some of them do not leave the cocoons until the following spring. The percentages of seeds damaged averaged 50.

Tunblad (B.). **Viktiga gallkvalster på fruktträd.** [Important Gall-mites on Fruit Trees.]—*Växtskyddsnotiser* 1953 no. 5–6 pp. 93–94. Stockholm, 1953.

Damage to pear and plum by Eriophyids has increased in Sweden in recent years. *Eriophyes pyri* (Pgst.) is the commonest on pears, especially on nursery stock, and causes small swellings on the leaves. *E. similis* (Nal.) and *Vasates* (*Phyllocoptes*) *fockeui* (Nal. & Trt.) both occur on plum. The first causes swellings on both leaves and fruit, whereas the latter occurs free on the lower surfaces of the leaves and causes thickening and other deformations. Control of the mites is briefly discussed.

Mathlein (R.). **Metylbromid som begasningsmedel mot förrådsskadedjur.** [Methyl Bromide as a Fumigant against Stored-product Pests.]—*Växtskyddsnotiser* 1954 no. 2–3 pp. 30–32, 2 figs. Stockholm, 1954.

In 1952, a large flour-mill in Sweden was fumigated with methyl bromide at a gas concentration of 15 oz. per 1,000 cu. ft. for 45 hours at a temperature of about 20°C. [68°F.]. The treatment gave complete mortality of all stages of *Calandra granaria* (L.), larvae of *Ephestia kuehniella* Zell., adults of *Tribolium confusum* Duv. and larvae of *Tenebrio molitor* L. exposed at seven points in the building, and killed all the various stages of *C. granaria* in grains of wheat at a depth of 1 ft.

Unsatisfactory results were given, however, in an old mill that could not be made gas-tight, though the concentration was doubled in view of the low temperature (10°C. [50°F.]) and fumigation was continued for 46 hours. Mortality of *E. kuehniella* and *C. granaria* was complete, but 30 per cent. of the larvae of *Tribolium* and 40 per cent. of those of *Tenebrio* survived, indicating their greater resistance to this fumigant, at least at low temperatures.

von Rosen (H.). **En ny kålbladstekel,** *Athalia glabricollis* **Thoms. som skadegörare på vitsenap.** [*A. glabricollis* as a new Pest of White Mustard.]—*Växtskyddsnotiser* 1954 no. 2–3 pp. 34–35, 1 fig. Stockholm, 1954.

Athalia glabricollis Thoms., which is normally rare in Sweden, was common on white mustard near Stockholm in 1954. Newly hatched larvae were observed at the end of June.

Thalenhorst (W.). **Vergleichende Betrachtungen über den Massenwechsel der Kiefernbuschhornblattwespen.** [Comparative Considerations on Fluctuations in the Numbers of Pine Sawflies.]—*Z. angew. Ent.* **35** pt. 2 pp. 168–182, 1 graph, 23 refs. Berlin, 1953.

Population densities of insect pests vary in response to many causes, and it is difficult to distinguish which are the immediate regulating factors. An attempt is made to do this for the Diprionine sawflies that attack pine in Germany and neighbouring countries, especially *Diprion pini* (L.), *Gilpinia frutetorum* (F.) and *Neodiprion sertifer* (Geoffr.), by a comparison of data in the literature and the author's own observations. Outbreaks of *D. pini* near Danzig [*R.A.E.*, A **27** 105] and in Holland [**34** 87] and northern Germany [**31** 122] were all suppressed mainly by egg parasites and were not much affected by natural enemies or diseases of the larvae or cocoon stages. Though predators were of value in two cases, their importance depends less on the severity of the outbreak than on the presence of undergrowth and other characters of the environment [*cf.* **34** 88]. Climatic factors cause some outbreaks to take an abnormal course, as when a prolongation of the diapause increases the importance of pupal parasites, and weather conditions are unfavourable to the egg parasites or delay the development of the second-generation larvae of the sawfly, so that they are killed by frost.

The geographical distribution of Diprionines shows few differences due to climatic adaptations. However, *D. pini* is most numerous on impoverished sites with sparse vegetation [*cf.* **34** 88] and in stands 60–100 years old,

whereas outbreaks of *G. frutetorum* and *D. similis* (Htg.) usually occur on pole-wood, and *N. sertifer* finds optimum conditions in young stands up to pole-wood size and is often injurious in thickets.

The greatest numbers of eggs per female are shown in a table for eight species. The maximum for *D. pini* (145) is 20 per cent. higher than those for any other species except *D. similis* (148), but this difference is not considered sufficient to account for the more frequent outbreaks of *D. pini*, especially as *D. similis* does not show the same tendency and *N. sertifer* is no more prolific than some very rare species. There are no specific differences in the sex ratios, at least among outbreak populations. It is therefore concluded that the pine Diprionines have equal potentialities as pests, and the fact that some break out frequently and others not is attributed to differences in the causes of natural mortality. The equilibrium between *D. pini* and its ecological environment is unstable, whereas that for a species such as *G. frutetorum*, in which the population seldom rises above a low level, is stable. For an outbreak of *G. frutetorum* to occur, this equilibrium must be upset by the breakdown of some important limiting factor. Observations on such an outbreak in Germany in 1951–52 [**42** 338] indicated that on that occasion the cause was a reduction in the quantity of resin produced by the needles, which apparently resulted from drought. It is pointed out in this connection that the frequency of outbreaks of Diprionines may depend on the specific factor of whether the eggs are laid singly or in rows in the needles and on the physiological reaction of the tree to this behaviour.

The fluctuations in population at the climax of outbreaks of *D. pini* in 1940 and *G. frutetorum* in 1949 are shown on a graph. The two species were numerically almost equal at each stage of development, and it is concluded that once the limiting factor was removed, the maximum populations of each that could be supported by pines of similar age and growth conditions were the same, slight differences in the rate of egg production being evened out by the action of parasites, predators and disease. Specific differences in the reactions of the sawflies to environment had no appreciable effect at first on the numerical changes in population, nor had the fact that the most important parasites of the larvae were not the same. An important specific difference was that larvae of both generations of *G. frutetorum* pupated in the soil, whereas in *D. pini* the first generation pupated on the trees and only the second (overwintering) generation did so in the soil. The outbreak of *G. frutetorum* collapsed owing to high parasitism of the cocoons in the litter by *Dahlbominus fuscipennis* (Zett.) [*cf.* **41** 250], but as the parasite restricted its activities to soil level, cocoons of *D. pini* on the trees escaped attack and the outbreak was suppressed by egg parasites. These were less effective against *G. frutetorum* because its eggs, being laid singly in the needles, are harder to find.

N. sertifer requires special consideration because it differs from the other Diprionines by overwintering in the egg stage and having only one generation a year. Bivoltine egg parasites are therefore unable to increase sufficiently on this species alone to suppress an outbreak, and the same is true of the multivoltine pupal parasites, owing to the long interval between the emergence of the sawfly adults in September and the appearance of the cocoons of the next generation in June. The most effective parasites of the larvae of this species are closely adapted to it and have only one generation a year. Diseases of the larvae are probably as important as in the case of *Diprion pini* and *G. frutetorum*, but although disease was said to have terminated an outbreak in 1935 [**25** 55], cocoons were not collected and the collapse may have come in the pupal stage, as with *G. frutetorum* in 1949 [**41** 250].

Müller (F. P.). **Die Zwiebellaus, *Rhopalomyzus ascalonicus* (Doncaster), Vorkommen in Deutschland und Lebensweise.** [The Shallot Aphid, *Myzus ascalonicus*, its Occurrence in Germany and Bionomics.]—*Z. angew. Ent.* **35** pt. 2 pp. 187–196, 19 refs. Berlin, 1953.

Myzus (*Rhopalomyzus*) *ascalonicus* Doncaster, which was described from England in 1946, infests numerous plants, chiefly onion and allied species, and is a vector of several virus diseases [*cf. R.A.E.*, A **40** 275–276, etc.]. It was recorded from northern and western France in 1951 and also occurs in Holland, where it was observed to be common on potato in the field. In 1950–52, it was found in five localities in Germany, chiefly in glasshouses, on chives (*Allium schoenoprasum*), *Pelargonium grandiflorum* and *Calceolaria* and, together with colonies of *M.* (*Myzodes*) *persicae* (Sulz.), on young shoots of chrysanthemum (*Chrysanthemum indicum*) and *Asparagus sprengeri*. The alates and apterae of *M. ascalonicus* resemble those of *M. persicae*, and characters differentiating the two species are given.

In glasshouse experiments in 1950–51, cultivated and wild tulips, *Lilium martagon*, chives, onions, *Allium scorodoprasum* and *Polygonatum multiflorum* were all heavily attacked, and injury was severe on all but the last two. *Poa annua* was colonised, but not maize, oats or wheat. Other plants accepted included *Stellaria media* and *Urtica urens*, which were heavily infested. *Ranunculus repens*, sugar beet, *Chenopodium album*, and potato were also attacked, but the Aphids left these plants after 2–3 weeks, possibly because the experimental temperature was too high. Field infestation has not been reported in central Germany, and this is attributed to the low atmospheric humidity.

No sexual forms were seen during the rearing experiments. Alates did not occur between May and August and were not numerous during the rest of the year, and it is concluded that *M. ascalonicus* is unlikely to be of importance as a vector of virus diseases in the field in central Europe. Development was retarded and reproduction reduced on plants exposed for long periods to direct sunlight, and many Aphids left them.

Roesler (R.). **Rote Spinne und Witterung.** [Red Spider and Weather.] —*Z. angew. Ent.* **35** pt. 2 pp. 197–200. Berlin, 1953.

The development of Tetranychid mites has been favoured by the warm, dry weather that has prevailed in Germany during the past ten years, and it is considered to have been further encouraged on fruit trees by pruning and cultivation of the soil beneath the trees, which tend to increase the amount of sunlight and warmth in the crowns, particularly in the case of bush trees, which are now widely grown. It therefore happens that well-tended orchards are more heavily infested than neglected ones [*cf. R.A.E.*, A **43** 83] and, as the former are frequently sprayed with DDT, the impression is given that DDT favours Tetranychids. The claim that DDT destroys their natural enemies is subject to reservations, since Coccinellids have been shown to be resistant to it, but BHC may be more harmful.

Temperatures were abnormally high and rainfall low in the Rhine Palatinate in 1952, and *Paratetranychus pilosus* (C. & F.) was numerous on fruit trees and vines. During a heat wave in July, however, when shade temperatures reached 40°C. [104°F.], many outbreaks on fruit trees collapsed, all stages of the mite being found dead on the leaves. *Tetranychus* spp. increased during this period. *T. telarius* (L.) (*urticae* Koch) was exceptionally numerous from the early summer onwards on vines, to which it migrated from weeds, and both this species and *T.* (*Amphitetranychus*) *crataegi* Hirst migrated from undergrowth to fruit trees immediately *P. pilosus* died out. Both species were present on apple and plum and to a

less extent on pear until September, though most of the mites sought winter quarters at the end of August. Migration to fruit trees had been observed in previous years, but had been obscured by the presence of *P. pilosus*. *Bryobia praetiosa* Koch was less numerous on fruit trees than in previous years. Though apparently able to withstand high temperatures, it is apparently less tolerant of them than other Tetranychids.

WICHMANN (H. E.). **Untersuchungen über** *Ips typographus* **L. und seine Umwelt. Die Ameisen.** [Investigations on *I. typographus* and its Environment. Ants.]—*Z. angew. Ent.* **35** pt. 2 pp. 201–206, 1 fig., 1 ref. Berlin, 1953.

In view of the importance ascribed to ants, especially forms of the red forest ant (*Formica rufa* L.), as predators of forest pests [*cf. R.A.E.*, A **42** 60, 279], observations are recorded on the small form (*minor*) of *F. rufa rufopratensis* Forel (small red forest ant), *F. fusca cinerea* Mayr, *Lasius niger niger* (L.), *L. fuliginosus* (Latr.) and *Myrmica rubra laevinodis* Nyl. on spruce infested by *Ips typographus* (L.) and on the first of these on pine infested by *I. amitinus* Eichh. in forests in Bavaria. Colonies of predacious ants are too rare in Germany to exert more than a local influence, and the observations recorded were made on single trees or small groups. Though various species of ants were seen carrying off examples of *I. typographus* that had died and fallen to the ground, none attacked the living Scolytids, even when they were exposed on the surface of the bark, but small numbers of females of *Pachyceras xylophagorum* Ratz., *Rhopalicus tutela* (Wlk.) and *Cocloides bostrichorum* Giraud, which parasitise the larvae of *I. typographus*, were captured by the small red forest ant, and *M. r. laevinodis* attacked the larvae of *Thanasimus formicarius* (L.), which are predacious in the galleries of the Scolytid, and also those of *Raphidia flavipes* Stein and *R. notata* F., which destroy the eggs of *Thanasimus* and *Medetera*. *F. f. cinerea* unsuccessfully attacked *P. xylophagorum* and *Rhopalicus tutela*.

RÖHRIG (E.). **Die Lärchengespinstblattwespe** *Cephaleia alpina* **Klug. Untersuchungen bei einer Massenvermehrung in Schleswig-Holstein.** [*C. alpina*, Investigations on an Outbreak in Schleswig-Holstein.]—*Z. angew. Ent.* **35** pt. 2 pp. 207–245, 12 figs., 21 refs. Berlin, 1953.

An outbreak of *Cephaleia alpina* (Klug), a sawfly that is seldom injurious, occurred in a large planting of Japanese larch, *Larix kaempferi* (*leptolepis*), about 21 years old in Schleswig-Holstein in 1948–49, and an account is given of investigations on its bionomics in the second year. Its distribution in Europe and the morphology of all stages are described.

The larvae overwintered 2–8 ins. deep in the soil (rarely in the litter) from late July to late March. In laboratory experiments, they survived exposure to extreme humidity or desiccation for a few days only, but could be kept indefinitely at 18°C. [64·4°F.] and 90–100 per cent. relative humidity. Larvae unearthed on 2nd April and kept in the laboratory mostly pupated after about a week at 14°C. [57·2°F.] and after about two weeks at 11·5°C. [52·7°F.], the pupal stage lasting 14 and 16 days, respectively. Pairing took place on grass stalks or twigs near the ground, and males and females that fed on sugar in the laboratory lived for up to 10 and 10–12 days, respectively, at 18°C. and 70 per cent. relative humidity. None of the females oviposited, and examples dissected when three days old contained an average of 37 eggs each.

The process of oviposition is described. The eggs were deposited singly in slits in the tips of the needles, on the short shoots, at first on twigs near

the ground and later in the crowns of the trees, where most of the eggs were found. Each egg was laid at some distance from the others, but several eggs of different ages were sometimes found on one shoot or even on the same needle. Normal larvae hatched from unfertilised eggs, but their sex was not determined. These individuals hatched in 17 days at 18°C., but the egg stage lasted 24–26 days in the field in very cold weather, and about three weeks is considered to be the normal duration.

The larvae began to spin immediately and developed singly in cylinders of webbing, feeding on needles that they bit off. The larval stage lasted for an average of 24 days at about 17–19°C. [62·6–66·2°F.] and 56–66 per cent. relative humidity and for 28 days at 13–14°C. [55·4–57·2°F.] and 72–75 per cent. relative humidity on *L. kaempferi*. European larch [*L. decidua*] was equally acceptable as a food-plant, but newly hatched larvae placed on spruce, *Picea abies* (*excelsa*), or fir, *Abies alba* (*pectinata*), died in 1–2 days, and third-instar larvae died in five days on spruce. Field observations confirmed these results. A caged female failed to oviposit on spruce but did so on larch; when its antennae were removed, it ceased ovipositing and died containing 23 eggs.

The larvae normally remained on the same twig throughout their development. They consumed each needle entirely, but normally avoided those from the long shoots; when fed on these alone from the second instar onwards, they required almost twice as long to complete their development and mortality was high. It is calculated that the larvae consumed 480 needles each from the short shoots during development. Larvae in the first and third instars survived without food for 1·5 and 4 days, respectively. Feeding and the ability to spin ceased together, the full-fed larvae working their way through the webbing and falling to the ground, where they overwintered beneath the crowns of the trees.

Larvae in the third and fourth instars were not affected by temperatures down to 5°C. [41°F.], but became inactive at 0°C. [32°F.]; after one hour or one day at −4°C. [24·8°F.], they became active in 8 and 10 minutes, respectively, when transferred to 20°C. [68°F.]. Activity was increased at 26°C. [78·8°F.] and intensified at higher temperatures, but ceased suddenly at 42°C. [107·6°F.], at which all larvae died in four hours. Adults in the field began to crawl in the grass at 13°C., flew at 16°C. [60·8°F.] and paired at 17°C.

The area infested by *C. alpina* is described. Considerable damage was caused in places in 1948, but 30–50 per cent. of the larvae died from a virus disease. The distribution of the larvae in the soil in April 1949 was very uneven and is shown on a map. The first adults (males) were seen on 29th April. Examples emerging from the soil were trapped during 1st–11th May, after which the soil beneath the cages was searched and the remaining larvae removed to the laboratory. These constituted 31–44 per cent. of the total soil population, and all remained in diapause.

Males emerged 3–4 days earlier than females and were 2·3–4·1 times as numerous. A few adults were still present at the end of May. The first eggs were deposited on 4th–5th May, and the majority between 12th May and 1st June. They were found mostly in warm, sunny parts of the crowns. The first larvae hatched between 26th May and 1st June. Defoliation of short shoots was evident by the first week in July, and about 90 per cent. of the larvae were on the long shoots, where they attacked the older needles at the base. Many of the younger larvae died of starvation. There was no evidence of migration to other trees, or even downwards to uninfested parts of the same tree, and the area of infestation had not increased as compared with the previous year. In the defoliated area, there was an average of one larva for every 14·2 short shoots.

About 1–2 per cent. of the eggs dried out, but no important abiotic factors of control were observed. The only insect enemy of the adults was *Formica rufa* L., which carried off only dead or weakened examples, since healthy ones flew away when attacked. Birds, though numerous, afforded little control. No parasites or predators of the eggs were seen. Cocoons of Ichneumonids were found attached to the larval skins of *C. alpina* in 10 of 45 places where larvae of the sawfly were unearthed in late April and early May. The percentage parasitism in the areas where it existed averaged 4·6. In the laboratory at 18°C. and 65 per cent. relative humidity, the adult parasites emerged on 18th May, before larvae were available for oviposition. About 30 per cent. of them proved to be *Xenoschesis fulvipes* (Grav.). Parasite adults were found in the field between 25th May and 1st June, also before larvae of *C. alpina* were present, and were unexpectedly numerous in places during the first week in July. A single Tachinid larva emerged from one larva of the sawfly, but died without pupating. General predators were no more numerous than in uninfested stands, and though ants captured larvae placed on their pathways or nests, they ignored those enclosed in webbing. Birds destroyed many larvae but failed to influence the course of the outbreak, and the virus disease infected only 1–2 per cent. of the total population by the end of the feeding period in 1949 and 2–3 per cent. of the larvae in the soil in September.

Götz (B.). **Zur Wirkung synthetischer Insektengifte gegen die Larven des Rebstichlers** *Byctiscus betulae* **L.** [On the Effect of synthetic Insecticides against Larvae of *B. betulae*.]—*Z. PflKrankh.* **60** pt. 8 pp. 397–406, 3 figs., 12 refs. Ludwigsburg, 1953. (With a Summary in English.)

Adults of *Byctiscus betulae* (L.) have been shown to be susceptible to DDT, lindane [almost pure γ BHC] and parathion, and since this weevil is of local importance as a pest of vines in south-western Germany, these three insecticides were tested there to ascertain whether they would also control the larvae in the rolled leaves. Proprietary preparations of unspecified strength were used. When the exterior of the rolled leaves was sprayed in the laboratory, control of the larvae was complete and nearly so for a lindane emulsified solution and suspension, respectively, but less satisfactory for emulsion sprays of parathion and DDT, so that suitable sprays applied against the ovipositing adults would also kill any larvae already present. Most of the rolled leaves ultimately drop to the ground and become incorporated in the upper soil layer, and soil treatments against the larvae were therefore tested. When a lindane emulsified solution was applied as a spray to soil containing rolled leaves, mortality of the larvae was complete in the upper 2 ins., very good down to 3½ ins., and perceptible at 7 ins. Subsequent watering increased effectiveness. A lindane dust adapted for soil application killed all larvae in rolled leaves placed in soil mixed with it, but had no effect on them when the treated soil formed a layer above or below the level of the larvae. Its effectiveness under the latter conditions was not increased by watering, but adults that developed beneath a layer of treated soil were unable to reach the surface.

Ext (W.). **Stachelbeermilbe als Hauslästling.** [*Bryobia practiosa* as a Household Pest.]—*Z. PflKrankh.* **60** pt. 8 pp. 407–408, 3 refs. Ludwigsburg, 1953.

Bryobia praetiosa Koch entered a house on the Kiel Canal in very large numbers in April 1953, constituting a nuisance, and control measures were

required. The mites gained access through the windows, and were most numerous on the sides of the house exposed to the sun, thousands of them being found on the outer walls. Spraying these and the grass surrounding the house with a combination of DDT and BHC gave unsatisfactory results [*cf. R.A.E.*, A **35** 361], but numbers were considerably reduced when the outer walls were sprayed with toxaphene and the house was surrounded with a belt of E 605 Staub [a dust of 2 per cent. methyl-parathion]. The mites disappeared about a month later, after a second toxaphene spray, but the treatment may not have been entirely responsible. Similar cases have been reported elsewhere in Germany, and the houses concerned have in each instance been surrounded by grass, which was heavily infested.

Schmiedeberg (J.) & Wasserburger (H. J.). **Die akute Giftigkeit des Hexachlorcyclohexan für den Menschen.** [The acute Toxicity of BHC to Man.]—*Anz. Schädlingsk.* **26** pt. 9 pp. 129–133, 33 refs. Berlin, 1953.

Details are given of five cases in which BHC smoke tablets were swallowed by young children and resulted in mild symptoms of poisoning that were easily treated by the usual methods, and of an experiment in 1951, in which the junior author, a healthy man 32 years of age, weighing 59·1 kg., swallowed 1 gm. pure γ BHC dissolved in 5 ml. vegetable oil with a slice of dry bread about two hours after a light meal. Symptoms including dizziness and headache appeared 30 minutes later, followed after 2½ hours by severe symptoms leading to unconsciousness. This phase lasted 15 minutes, after which an improvement set in. A more serious second attack occurred 5½ hours after the first and was accompanied by tremors, foaming at the mouth and unconsciousness. Death appeared likely to ensue, and treatment was applied. This consisted of blood-letting and infusion of saline with grape-sugar solution, followed by blood transfusions on the two subsequent days. Recovery was complete. There were no gastro-intestinal symptoms and no rise in temperature. BHC was demonstrated in the blood two hours after administration, but could not be shown in the urine. It is concluded that the dose of nearly 17 mg. per kg. body weight was close to the lethal dose. The treatment of BHC poisoning is briefly discussed.

Düzgüneş (Z.). **Türkiyede yeni bulunan bir akar:** *Brevipalpus pyri* **Sayed.** [A Mite new to Turkey.]—*Tomurcuk* **3** no. 28 pp. 6–8, 1 fig., 5 refs. Istanbul, 1954. (With a Summary in English.)

Brevipalpus geisenheyneri (Rübs.) (*pyri* Taher Sayed) [*cf. R.A.E.*, A **43** 21] was observed on apple near Ankara in 1951, for the first time in Turkey [*cf.* **42** 135]. Observations in 1952 showed that this mite, the adults and eggs of which are described, has two generations a year. The adult females overwinter and oviposit in early May. The eggs hatch towards the end of the month, and the population reached its peak at the beginning of July. Males occur from June to the end of September. The acaricides normally used for the control of Tetranychids proved ineffective against *B. geisenheyneri*.

Keyder (S.). *Aphelinus diaspidis*.—*Tomurcuk* **3** no. 31 pp. 8–9, 1 fig. Istanbul, 1954. (In English, with a Summary in Turkish.)

Aphytis proclia (Wlk.) (*Aphelinus diaspidis* (How.)) was observed for the first time in Turkey in 1949, when it was found parasitising *Pseudaulacaspis* (*Diaspis*) *pentagona* (Targ.) on mulberry. Observations on its

bionomics showed that it has 2–3 generations a year depending on weather. It passed the winter of 1949–50 as full-grown larvae and pupae and that of 1950–51 as full-grown larvae. The adults emerged at the end of March or the beginning of April, and the eggs were laid through the scales of the female Coccids. The larvae hatched in a month or more and pupated after 20–30 days. The duration of the pupal stage varied with the weather, the minimum observed being 12–15 days. Considerable control of the Coccid appeared to be given.

Nizamlioğlu (K.). **Türkiyede yeni bir meyve zararlısı tanıtiyoruz:** *Tanymecus dilaticollis* **Gyll.** [A new Fruit-tree Pest in Turkey.]—*Tomurcuk* **3** no. 32 pp. 8–9, 2 figs., 2 refs. Istanbul, 1954.

Adults of *Tanymecus dilaticollis* Gylh., which attack numerous field crops in Turkey, caused considerable damage to fruit trees for the first time in 1951. Those attacked included peach and apple, and injury to the shoots was severe.

Nizamlioğlu (K.). **Türkiyede yeni bulunan bir kaç faydalı parazit.** [A few useful Parasites new to Turkey.]—*Tomurcuk* **3** no. 34 pp. 10–12, 4 figs. Istanbul, 1954. (With a Summary in English.)

The parasites here recorded for the first time from Turkey are *Ascogaster* sp. from the pupae of *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple, *Agria affinis* (Fall.) and *Carcelia* sp. from *Lymantria dispar* (L.), and *Pimpla instigator* (F.) from the pupae of *Malacosoma neustria* (L.).

Martin (Henri). **Olive Psyllid in Libya, 1953/54.**—*FAO Plant Prot. Bull.* **2** no. 12 pp. 184–186. Rome, 1954.

Euphyllura olivina (Costa) is widely distributed on olive in Tripolitania, but occurs in no other part of Libya and is most injurious in the humid regions of the western coast [*cf. R.A.E.*, A **26** 260]. The adults overwinter, and observations on the Psyllid near Tripoli in 1953 showed that egg-laying began about the second half of March and continued until May. First-generation nymphs, which feed on the unopened flower buds, occurred from the end of March to early June, the egg and nymphal stages lasting 10–15 and about 30 days, respectively. Infestation was slight between November 1953 and February 1954, increased again from the end of that month, when the inflorescences were forming, but later diminished, and damage ended completely by late June or July, after which only adults were found.

In experiments on control in 1953, infested branches were sprayed in the laboratory in April and the results recorded after five days. Complete mortality of nymphs was given by 0·5 per cent. nicotine sulphate, with 1 per cent. soap, 0·4 per cent. of a product (Nicotox) containing 20 per cent. nicotine, and 0·1 per cent. of a product (Etilon) containing 20 per cent. parathion. In a field test in the second half of April, examination of the branches about one week after treatment showed that the numbers of spots (each infested with approximately 5–10 nymphs) with dead and (in brackets) living nymphs were 15 (0) and 25 (7) for 1 and 0·5 per cent. nicotine sulphate with 1 per cent. soap, 46 (4) and 14 (7) for 0·3 per cent. Nicotox alone and with 1 per cent. white oil, 51 (7) for 0·4 per cent. Nicotox, 80 (0) and 7 (23) for 0·1 per cent. Etilon alone and with 1 per cent. white oil, 40 (0) for 0·15 per cent. Etilon, 51 (24) for 0·1 per cent. DDT with 1 per cent. white oil, 100 (0) and 50 (0) for 0·1 and 0·2 per

cent. γ BHC as lindane in an emulsion spray, and 48 (2) for 0·5 per cent. BHC dust. In a subsidiary test, treatment with power equipment gave good results. Since olive trees with an even crown and good aeration are usually less infested by insects, the effect of pruning was investigated in 1953–54. The numbers of infested spots in April 1954 were 62 and 229 on 33 branches from pruned and unpruned trees, respectively, the numbers per branch being 0–12 and 3–12.

Outbreaks and new Records.—*FAO Plant Prot. Bull.* **2** no. 12 pp. 187–189; **3** no. 1 pp. 11–12, 1 fig. Rome, 1954.

K. Sawada (p. 188) reports from Japan that *Merodon* (*Lampetia*) *equestris* (F.) was found on *Narcissus* there in July 1953 and that the potato tuberworm, *Gnorimoschema operculella* (Zell.), was found in early 1954. Both are new records for Japan.

It is recorded from the United States (p. 189) that *Tetranychus* (*Eotetranychus*) *tiliarius* (Herm.) was recently collected on *Tilia platyphyllos* in Massachusetts, for the first time in that country.

W. J. Hall reports (p. 12) that a sudden outbreak of *Aleurocanthus woglumi* Ashby on *Citrus* recently caused the death of many lime and orange trees in the Seychelles. The Aleurodid has not previously been recorded from these islands, although growers believe it to have been present for many years.

Narayanan (E. S.) & Kundan Lal. **Studies on Chalcid Egg Parasites of *Pyrilla* spp. occurring in Delhi. Part I. Bionomics of *Tetrastichus pyrillae* Craw., *Ageniaspis pyrillae* Mani and *Cheiloneurus pyrillae* Mani.**—*Indian J. Ent.* **15** pt. 3 pp. 173–179, 4 refs. New Delhi, 1953.

In Delhi, the eggs of *Pyrilla* spp., which are important pests of sugar-cane, are parasitised by *Tetrastichus pyrillae* Crwf., *Ageniaspis pyrillae* Mani and *Cheiloneurus pyrillae* Mani, and weekly records made between October 1949 and February 1950 showed the first of these to be the most useful. *Pyrilla* was observed in the field in the first week of May 1949, but became scarce and disappeared as the temperature rose. It appeared again in September, two months later than usual, and *T. pyrillae* was first observed in October, when the temperature was 24·3°C. [75·74°F.] and the relative humidity 71 per cent. *T. pyrillae* was most active in October and November, when it parasitised 10 and 15·85 per cent., respectively, of the eggs. *A. pyrillae* and *C. pyrillae* appeared in the first week of December, when the percentages of eggs parasitised by these and *Tetrastichus* were 0·69, 0·08 and 4·9, respectively. *Cheiloneurus* disappeared in January, but *Tetrastichus* and *Ageniaspis* parasitised 4·27 and 1·5 per cent. of the eggs in that month and 3·93 and 2·6 per cent. in February. In the laboratory, *Tetrastichus* passed through six generations from October to February, with an average life-cycle of 10–36 days, according to temperature; the ratio of females to males was almost 3:1.

Reddy (D. B.). **Effect of short Exposures to low Temperatures on the third larval Instar of the Rice Weevil.**—*Indian J. Ent.* **15** pt. 3 pp. 180–182, 1 ref. New Delhi, 1953.

In tests in which rice kernels containing third-instar larvae of *Calandra* (*Sitophilus*) *oryzae* (L.) were exposed to constant temperatures of 0, 2·5,

5, 13 and 16°C. [32, 36·5, 41, 55·4 and 60·8°F.] for varying periods and then kept at 26·6°C. [79·88°F.] and 75 per cent. relative humidity until the adults emerged, it was found that exposure for 6–24 hours had no effect on either the larvae or the emerging adults. Exposure for 72 hours had no effect except at 0°C., at which about 30 per cent. of the larvae died and the adults that emerged were smaller and lighter than those from larvae kept at 26·6° throughout. About 35 per cent. of the adults died within 45 days. When the exposure period was extended to 144 hours, 30 per cent. of the larvae died at 0°C. and 12·5 per cent. at 2·5°C. The length of the developmental period increased and the average weight of the emerging adults decreased as the temperature fell from 26·6 to 0°C. Mortality of adults in 45 days was greater in those from cultures exposed to 0, 2·5 or 5°C. than from those exposed to 13 or 16°C., and very low among those kept at 26·6°C. throughout. There appeared to be a direct correlation between weight and adult survival. There were slightly more males than females after exposure to very low temperatures, but numbers became more equal as the optimum was approached.

Chaudhuri (R. P.). **Control of Cutworms in Potato Fields.**—*Indian J. Ent.* **15** pt. 3 pp. 203–206, 1 fig., 7 refs. New Delhi, 1953.

About 40 per cent. of a potato crop planted at Patna on 10th November 1952 was damaged by cutworms, mainly *Agrotis ypsilon* (Hfn.), by 7th January 1953, and control experiments were therefore carried out, dusts containing 5 per cent. DDT with pyrethrins or 5 per cent. toxaphene, being applied to the surface of the soil round the plants at the rate of 30 lb. per acre. Both treatments afforded protection until harvest and caused considerable mortality of larvae, the toxic effect persisting for more than 20 days. The DDT dust was the more rapid in action. Examination of tubers at harvest showed that the DDT and toxaphene dusts reduced the percentage of tubers damaged from 24·7 to 4·4 and 9·2 and the percentage weight of tubers rendered unsaleable from 30·1 to 4·5 and 11, respectively. The dusts were not applied until some damage had occurred, and the improvement in yield would probably have been greater had they been used earlier.

Rattan Lal & Lal Gupta (S. B.). **Morphology of the immature Stages of *Sphaerophoria scutellaris* (Fabr.) (Syrphidae: Diptera) with Notes on its Biology.**—*Indian J. Ent.* **15** pt. 3 pp. 207–218, 22 figs., 10 refs. New Delhi, 1953.

Sphaerophoria scutellaris (F.), the immature stages and the developmental processes of which are described, preys on Aphids in India, affording useful control. Investigations on its bionomics were made at Delhi in 1950–51, adults collected in the field being caged on mustard plants infested by *Rhopalosiphum pseudobrassicae* (Davis). The following is based on the authors' summary of the results. During January and February 1951, at an average daily temperature of 61·1°F. and 56·3 per cent. relative humidity, males and females that had paired lived for about 9–10 and 13–14 days, respectively, and the preoviposition and oviposition periods were about 5–6 and 6–7 days. The females oviposited on the plants. The number of eggs laid per female was 29, and the egg, larval, and pupal stages lasted about 2–4, 9–11 and 8–10 days, respectively. The larvae attacked one another in the absence of Aphids, and survived without food for long periods

provided that water was available. Experiments at constant temperatures of 18, 25 and 30°C. [64·4, 77 and 86°F.] and 70 per cent. relative humidity showed that adults fed with 5 per cent. sugar solution lived significantly longer than those fed with 5 per cent. honey solution or distilled water and that those fed on sugar lived significantly longer at the lowest temperature than at the others.

David (A. L.) & Muthukrishnan (T. S.). **The Prickly Pear Cochineal: Observations on its natural Hosts and Enemies in South India.**—*Indian J. Ent.* **15** pt. 3 pp. 219–224, 3 figs., 15 refs. New Delhi, 1953.

The authors report that *Dactylopius opuntiae* Ckll. (*tomentosus*, auct.). which feeds on the prickly pears, *Opuntia dillenii* and *O. elatior* (*nigricans*). in southern India, has been found in large numbers at Coimbatore on the spineless cactus, *Nopalea coccinellifera*, which can therefore serve as an alternative food-plant, and that *Cryptolaemus montrouzieri* Muls. and *Brumus suturalis* (F.) were observed attacking *D. opuntiae* on patches of *O. dillenii* in the Nilgiris and at Coimbatore, respectively.

Samuel (C. K.) & Chatterji (S.). **Studies on the varietal Resistance and Susceptibility of " Jowar " (*Andropogon sorghum*) to Storage Pests in India.**—*Indian J. Ent.* **15** pt. 3 pp. 225–239, 2 graphs, 2 refs. New Delhi, 1953.

Investigations in which grain from 24 varieties of sorghum grown in India were tested for resistance to attack by *Corcyra cephalonica* (Staint.), *Rhizopertha dominica* (F.), *Sitotroga cerealella* (Ol.), *Lathecticus oryzae* Waterh., *Tribolium castaneum* (Hbst.) and *Calandra oryzae* (L.) showed that a non-huskable variety was almost totally resistant to all but *R. dominica*.

Sen (A. C.) & Prasad (D.). **Pests of Banana in Bihar.**—*Indian J. Ent.* **15** pt. 3 pp. 240–246, 3 figs., 2 refs. New Delhi, 1953.

Banana, an important crop in Bihar, has been severely damaged in recent years by *Nodostoma viridipenne* Motsch. and *Cosmopolites sordidus* (Germ.). The three principal varieties are very susceptible to both pests, with the result that losses have been severe. The adults of *Nodostoma*, which are present in the field from May to February, injure the central leaves forming the top whorl of the plant and also attack the newly formed fruits, causing most destruction in August and September. Damage by *Cosmopolites* becomes serious in April–October. The eggs are deposited in the plant at ground level, and the larvae riddle the rhizome and bore up the stem; 6–10 have been found in a stem and 15–20 in a single stool. Plants of all ages are attacked, and infested ones snap at the point of infestation in a strong wind or produce few fruits and very few suckers.

In spray tests, single applications of 0·125 per cent. wettable DDT in August gave 49·1 and 42·9 per cent. reduction in *Nodostoma* populations in 1950 and 1951, respectively, and three applications of 0·16 per cent. DDT at fortnightly intervals in July–September in 1950–52 to uninfested plants reduced the percentage attack by *Cosmopolites* from 15·6–19·5 to 1·4–4·1.

Patel (N. G.) & Patel (G. A.). **Bionomics of Wheat Thrips** (*Anaphothrips flavicinctus* **Karny**) **in the Bombay State.**—*Indian J. Ent.* **15** pt. 3 pp. 251–261, 4 figs., 7 refs. New Delhi, 1953.

Anaphothrips flavicinctus (Karny), all stages of which are described, is an important pest of wheat in the State of Bombay. It has been collected in northern, southern and western India from various graminaceous and other plants, a list of which is given, and breeds throughout the year. Both the nymphs and adults feed on the leaves, generally remaining inside the sheath but causing a characteristic whitening that is visible over the whole leaf blade. Reproduction is sometimes parthenogenetic, but usually occurs after fertilisation. Observations on the bionomics of the thrips showed that the eggs are deposited in the leaf tissue, usually in tender foliage near the sheath. In the laboratory, females lived for 18–23 days and deposited 24–67 eggs each. About half the eggs died, and the rest hatched in 6–13 days. The two nymphal instars and the prepupal and pupal stages lasted 2–4, 1–4, 1–3 and 1–4 days, respectively. In the field, the nymphal population reaches a maximum when the crop is fully grown and then decreases suddenly. Observations in 1950–52 indicated that peaks of abundance coincided with the lowest temperatures of the growing season, and it is concluded that *Anaphothrips* becomes numerous only when the weekly average temperature is below 70°F. in winter, and that it will not increase in other seasons, including the monsoon, even though a large number of its cultivated food-plants are then available.

Armstrong (T.). **Summary of Studies on new Acaricides in Canada, 1948–1953.**—*84th Rep. ent. Soc. Ont. 1953* pp. 35–45, 5 refs. [Guelph, Ont., 1954.]

Notes are given on the effectiveness in sprays against *Tetranychus bimaculatus* Harvey, *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.), and other mites that attack fruit trees in Canada, of 20 acaricides developed since 1948 and hence not included in a previous review [*R.A.E.*, A **38** 313], based on greenhouse experiments in Ontario and orchard investigations in various districts. Ovotran (p-chlorophenyl p-chlorobenzenesulphonate) was effective against eggs and immature mites, and showed prolonged ovicidal toxicity [*cf.* **39** 87]. Sulphenone (p-chlorophenyl phenyl sulphone) was particularly effective against *T. bimaculatus* and rather less so against *P. pilosus*; it destroyed active forms and eggs and had prolonged residual action. Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite) had poor ovicidal toxicity but killed the active forms of both mites satisfactorily for at least a week after application. The first two of these acaricides were compatible with all the common spray materials, and the third with all except hydrated lime and bordeaux mixture. They do not appear to cause foliage injury and are in use in orchard control programmes.

Bis(p-chlorophenyl)-ethoxymethyl-carbinol and 2-hydroxy-2,2-bis(p-chlorophenyl)-ethyl acetate (Chlorobenzilate) both showed good acaricidal properties. The latter was the better against *T. bimaculatus* in the greenhouse, having longer residual toxicity and a more pronounced ovicidal action, but it was phytotoxic in some orchard tests, in which both gave satisfactory control of *P. pilosus*. Both materials were compatible with common insecticides and fungicides. Butoxypolypropylene glycol showed considerable promise against both mites, but the residues were readily washed from the foliage. Illoxol, stated to contain 60 per cent. polychloroendomethylenetetrahydroindene, possessed both insecticidal and acaricidal properties,

destroying Aphids, *Psylla pyricola* Först. and *Conotrachelus nenuphar* (Hbst.) as well as mites. It killed the active forms of *T. bimaculatus*, but not the eggs, was less effective as an acaricide than several other compounds tested, and caused severe injury to peach, plum and pear in orchard tests.

Glyoxalidine (2-heptadecylglyoxalidine acetate), which is primarily a fungicide, destroyed fairly high proportions of active mites, but had no ovicidal action or residual toxicity. Dinitrocaprylphenylcrotonate (Arathane) gave variable results and caused some foliage injury.

The outstanding acaricides among the phosphorus compounds tested were EPN (ethyl p-nitrophenyl thionobenzenephosphonate) and malathion, and both of these gave good results in orchard tests. EPN gave very good control of several species of mites and insects and, owing to its prolonged toxicity [*cf.* **39** 87], was superior to parathion as an acaricide. N,N-diethylthiocarbamyl O,O-diisopropyl dithiophosphate showed considerable promise in the greenhouse, but did not have the long-lasting residual action of some of the other phosphates, and further investigation of it in the field is required. The systemic toxicants, schradan and demeton (diethyl 2-(ethylmercapto) ethyl thiophosphate), were outstanding. They were effective in foliage sprays at very low concentrations, and their effect persisted for several months; in this respect, demeton was superior to schradan. In the greenhouse, diethyl 2-(ethylseleno)ethyl thiophosphate was even more effective as a systemic acaricide than demeton, and left residues that gave complete mortality for at least 17 days, the duration of the experiment. It was not investigated in the field.

Other compounds tested comprised 2,4-dichlorophenyl benzenesulphonate, which had a good immediate but poor residual effect, Metacide (methylparathion and a smaller quantity of parathion), which was effective against the active forms but showed poor ovicidal and residual toxicity, diethyl 4-methyl-7-coumarinyl thionophosphate (Potasan), which was about as effective as parathion in the greenhouse, with possibly better residual toxicity but poor ovicidal action, and dimethyl 3-chloro-4-nitrophenyl thionophosphate (Chlorthion) and diethoxy thiophosphoric azide, which gave only fair results.

Wressell (H. B.). **The European Corn Borer, *Pyrausta nubilalis* (Hbn.) (Lepidoptera: Pyralididae), in Canada: a Review.**—*84th Rep. ent. Soc. Ont. 1953* pp. 45–48, 19 refs. [Guelph, Ont., 1954.]

Pyrausta nubilalis (Hb.) occurred on maize in all provinces of Canada but Newfoundland, Alberta and British Columbia in 1953. It spread rapidly through the maize-growing areas of Ontario in 1920–30, but decreased considerably after the introduction in 1927 of legislation requiring farmers to dispose of the stubble in spring, which destroys the overwintered borers, though the main factor responsible was the weather, high temperatures and low rainfall in June and July, such as occurred particularly in 1934, resulting in low populations. The planting of large areas with hybrid maize from 1938 onwards also reduced infestation, but the spread of the multivoltine strain of *P. nubilalis* [*cf. R.A.E.*, A **37** 283] in 1940 and later caused important changes. The first generation of this strain damages the stems and the second the ears, and under suitable conditions feeding on the kernels and boring into the sheath cause severe ear damage. Maize for canning is most affected. The insect appeared in Quebec in 1926 and is regarded there as a serious pest of sweet and canning maize; there was evidence of a partial second generation in the area south of Montreal in 1953. It was found in New Brunswick in 1928–30 and again in 1945, since when it has become established. It is now considered a permanent pest

of sweet maize there. In Nova Scotia, the borer, apparently the multivoltine strain, is regarded as a serious pest in the Annapolis Valley. It appeared in Saskatchewan and Manitoba in 1949, and has caused considerable damage in the latter Province. Two larvae found in 1949 constitute the only known record for Prince Edward Island.

Boyce (H. R.) & Dustan (G. G.). **Parasitism of Twig-infesting Larvae of the Oriental Fruit Moth,** *Grapholitha molesta* **(Busck) (Lepidoptera: Olethreutidae), in Ontario, 1939–1953.**—*84th Rep. ent. Soc. Ont. 1953* pp. 48–55, 2 refs. [Guelph, Ont., 1954.]

In Essex County and the Niagara Peninsula of Ontario, reliance was placed on weather conditions, indigenous natural enemies and the introduced parasite, *Macrocentrus ancylivorus* Rohw. [*cf. R.A.E.*, A **38** 486], for the control of *Cydia* (*Grapholitha*) *molesta* (Busck) on peach in 1929–44, but as a result of a severe infestation in 1945, sprays of DDT were used in commercial orchards from 1946–48 onwards, and parathion, which also controls mites, in some from 1949.

Examinations of twig-infesting larvae of the first two generations in 1939–53, the results of which are given in tables, showed that although *M. ancylivorus* was liberated extensively in Essex County in 1936–39 and 1946–47 and not in the Niagara Peninsula after 1935, it was considerably more abundant in the second of the two areas after 1939, and that since the introduction of DDT and parathion, there has been a general increase of the first generation of the parasite in Essex County and of the first two in the Niagara Peninsula, with yearly fluctuations more marked in the former. Thus, the parasitism percentages for the first and (in brackets) the second generation before and after the use of the insecticides averaged 5·8 (27) and 20·1 (31·3) in Essex County and 24 (43) and 42·3 (59·9) in the Peninsula. It is possible that both DDT and parathion favour the parasite in some indirect manner.

Of the native parasites, *M. delicatus* Cress., has always been much more abundant in Essex County than in the Peninsula, and its numbers increased steadily in the former but remained at a low level in the latter after the introduction of DDT. Populations of *Angitia* (*Horogenes*) *obliterata* (Cress.) appeared to be somewhat reduced and those of *Glypta rufiscutellaris* Cress. rather drastically so by DDT and parathion, but the second of these is still common on its native host, *Eucosma* (*Epiblema*) *strenuana* (Wlk.).

Coppel (H. C.) & Arthur (A. P.). **Notes on introduced Parasites of the European Pine Shoot Moth,** *Rhyacionia buoliana* **(Schiff.) (Lepidoptera: Tortricidae), in Ontario.**—*84th Rep. ent. Soc. Ont. 1953* pp. 55–58, 1 map. [Guelph, Ont., 1954.]

In Canada, *Rhyacionia buoliana* (Schiff.) feeds on the native pines, *Pinus strobus* and *P. resinosa*, and on many introduced European species. Parasites released for its control in southern Ontario in 1928–53 included six from England and three from continental Europe. In 1953, over 7,000 larvae and pupae of *R. buoliana* were collected from seven localities and reared singly, and eight native and three of the introduced parasites were obtained from them. Total parasitism ranged from 1·96 to 10·86 per cent., and the introduced parasites contributed two-thirds or more of the total in all areas. Of the introduced species, *Orgilus obscurator* (Nees) [*cf. R.A.E.*, A **19** 29, 34] was the most abundant and widespread, and *Cremastus interruptor* Grav. was second in importance, both these having been released

in 1928–49, and *Tetrastichus turionum* (Htg.) was recovered in one area, this being the first record of the establishment of this Eulophid in Canada since its release in 1938 [*cf.* **25** 594]; it was more abundant at the time of collection than any native parasite obtained in the area. The degree of parasitism by native species rarely exceeded 0·5 per cent. Of the other introduced parasites, records show that one female of *Campoplex mutabilis* (Hlmgr.) was reared in 1943 (the last year of release), and that *Pimpla turionellae* (L.), liberated in 1935–53, was recovered in various places in 1937, 1941 and 1943. *Copidosoma geniculatum* (Dalm.), *Campoplex rufifemur* (Thoms.) and *Ephialtes ruficollis* (Grav.), which were released in 1934–36, 1935, and 1933–42, respectively, have not been recovered from *R. buoliana.*

Maybee (G. E.). **Introduction into Canada of Parasites of the Carrot Rust Fly, *Psila rosae* (F.) (Diptera: Psilidae).**—*84th Rep. ent. Soc. Ont. 1953* pp. 58–62, 1 graph, 12 refs. [Guelph, Ont., 1954.]

Psila rosae (F.) causes serious losses of carrots in British Columbia, Ontario and other parts of Canada, and since the parasites, *Dacnusa gracilis* (Nees) and *Loxotropa tritoma* (Thoms.), afford important control of the fly in England [*cf. R.A.E.*, A **35** 213], they were introduced and released in British Columbia in 1949–53 and 1950–53, respectively, at Bradford, Ontario, in 1949–51 and in Prince Edward Island in 1953. Field-cage tests at Bradford showed that *D. gracilis* attacked young larvae of *P. rosae*, and *L. tritoma* the puparia (and not the larvae, as previously thought [*cf.* **35** 214]). *L. tritoma* survived the winter in the field, but material was insufficient to allow this to be verified for *D. gracilis*. Attempts to rear the latter in the laboratory were unsuccessful. Adults of both species were recovered at Bradford in 1951, but not in 1952–53.

Musgrave (A. J.) & Kukovica (I.). **Rapid Insecticide Tests with Aphids.**—*84th Rep. ent. Soc. Ont. 1953* pp. 63–70, 3 figs., 12 refs. [Guelph, Ont., 1954.]

The authors describe an effective and rapid technique developed in Canada for testing chemicals for contact toxicity to Aphids. The test insects used are *Aphis fabae* Scop. and *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)), and they are reared on broad bean in alternate cages in an apparatus already described [*R.A.E.*, A **39** 48] and tested by spraying with emulsified solutions in a Potter tower [**40** 185]. After treatment, they are caged with young bean plants and examined for mortality in 24 and 48 hours, and the results are compared with those for no treatment and spraying with the carrier only or an emulsified solution of γ BHC. It was found that effective compounds were easily distinguished, and that differences in the response of the two species could sometimes be detected. Numerous compounds, mainly chlorinated hydrocarbons, were investigated, and lists of them are given classified as non-toxic (less than 40 per cent. mortality of both Aphids caused by 1 per cent. active compound in emulsified benzene solution), slightly toxic (40–60 per cent. mortality of either of them) and highly toxic (60–100 per cent. mortality of either). The last group comprised γ BHC, rotenone, p,p′-dichlorobenzhydryl β-chloroethyl ether, 3-nitro-4-methoxybenzyl β-chloroethyl ether, p-xylylene bis(β-chloroethyl ether) and a 1:1 mixture of the first and last. *A. fabae* was more resistant to γ BHC than *M. pisum*, whereas nitromethoxybenzyl chloroethyl ether and xylylene bis(chloroethyl ether) were highly toxic to *A. fabae* but almost non-toxic to *M. pisum* at 1 per cent.

Monro (H. A. U.), Buckland (C. T.) & King (J. E.). **Preliminary Observations on the Use of the Thermal Conductivity Method for the Measurement of Methyl Bromide Concentrations in Ship Fumigation.** —*84th Rep. ent. Soc. Ont. 1953* pp. 71–76, 3 figs., 3 refs. [Guelph, Ont., 1954.]

Methyl bromide has proved an effective fumigant for the control of insects in the empty cargo spaces of ships [*cf. R.A.E.*, A **40** 381], and the distribution of effective gas concentrations has been studied by means of test insects [*cf.* **40** 382], but owing to the lack of a method of making a continuous record that would be convenient under conditions of ship fumigation, concentration and distribution were not tested by chemical means and there was no exact knowledge of the rate of loss of fumigant during aeration of the holds under different climatic conditions.

Phillips & Bulger (1952) have recently developed an apparatus in which thermal conductivity is used to obtain a continuous record of methyl-bromide concentration in air under field conditions. It is based on the fact that when an electric current is passed through a wire, the final equilibrium temperature of the wire is affected by the thermal conductivity of the gas surrounding it. If the composition of the gas is changed, its thermal conductivity will be affected and the equilibrium temperature and therefore the resistance of the wire will alter. The apparatus is described, and an account is given of a test in which it was used on a ship in harbour during the fumigation of an empty hold infested with *Plodia interpunctella* (Hb.), *Alphitobius diaperinus* (Panz.) and *Carpophilus dimidiatus* (F.), the nominal dosage of methyl bromide being 1 lb. per 1,000 cu. ft. and the exposure lasting for ten hours. Gas samples were taken from four points in the hold at intervals until ventilation began and then from the bottom of the hold until it was complete. It was found that the gas concentration was maintained at a high value throughout the treatment and that all detectable methyl bromide had dispersed within 90 minutes of the beginning of ventilation.

Richardson (H. P.) & Allen (W. R.). **Notes on the Life-history, Habits, and Control of the Apple Seed Chalcid,** *Torymus druparum* **Boh. (Hymenoptera: Chalcididae).**—*84th Rep. ent. Soc. Ont. 1953* pp. 76–79, 1 ref. [Guelph, Ont., 1954.]

At an experiment station at Morden, Manitoba, where hardy varieties of crab-apple and apple are being developed for the prairie regions of Canada, *Torymus druparum* Boh. caused 50 per cent. destruction of the seed produced for this purpose in 1944, and investigations on the bionomics and control of the Torymid were therefore begun in 1945. In Manitoba, crab-apple is the main food-plant, apple and pear are not very suitable because the larger size of the fruits usually prevents oviposition in the seeds, and mountain ash (*Sorbus aucuparia*) was only lightly infested and the adults reared from it small. *T. druparum* overwinters as a larva in the seed and pupates at the end of May. The pupal stage lasts 17–19 days, and the adults emerge over about three weeks from 18th June. Females provided with granulated sugar and water lived for 19–32 days and males for half as long; the preoviposition period was 2–4 days. The wound made by the ovipositor appears as a brown streak from skin to seed, and repeated oviposition distorts the fruit. Only one larva develops in each seed, though more than one egg may be deposited. It was shown that some of the larvae remain in diapause for two winters.

In a test on edible and ornamental crab-apple seedlings, DDT applied at the rate of 1 lb. per 100 gals. reduced the average percentage of seeds infested from 28·5 and 10·3 to 3·9 and 4·6, respectively, in 1945 and from 69·2 and 53·3 to 15·3 and 10·9 in 1948. Chlordane at the same rate in 1948 had little value. In 1948–52, DDT was very effective in mixed plantings at 0·75 lb. per 100 gals. if applied when adult emergence was beginning, but much less so if spraying was delayed. The small size of the insects makes emergence difficult to use as a means of timing, and it has been impossible to relate it with any other natural phenomena, but records in 1945–46 and 1948–53 showed that emergence began on 17th–19th June except in 1946 and 1952 (when it began on 11th and 7th June, respectively), and as the preoviposition period lasts about three days, it is concluded that 18th June would be a satisfactory date to begin spraying.

Begg (J. A.). **Residual Control of Wireworms in flue-cured Tobacco.**—*84th Rep. ent. Soc. Ont. 1953* pp. 79–82, 4 refs. [Guelph, Ont., 1954.]

The following is based on the author's introduction and conclusions. BHC, incorporated into the soil as a dust or combined with granular fertiliser, gave effective control of wireworms in flue-cured tobacco at Chatham, Ontario, in 1947 and has since been one of the accepted means of control in south-western Ontario. To test the duration of their effectiveness, BHC and other insecticides were applied in 1948 to sandy loam soil in fields used for the production of flue-cured tobacco in an area in which *Limonius agonus* (Say) was the principal wireworm. Population counts made in 1948–53 showed that BHC, worked into the soil at the rate of 3·84 oz. γ isomer per acre, satisfactorily controlled *L. agonus* for five years in a rotation of tobacco and rye, wireworm injury to tobacco grown in the treated soil being negligible. Ethylene dibromide and DD mixture [a proprietary mixture of 1,3-dichloropropene and 1,2-dichloropropane], injected into the soil, satisfactorily reduced the wireworm population in the year of application, but reinfestation occurred after 1949; the rate of reinfestation was reduced by the general treatment of cultivated land in the area with BHC. Chlordane at 1 lb. per acre (considerably less than the present recommended rate) reduced the population slightly, and DDT at 1 lb. per acre appeared to have little or no effect.

Boyce (K. E.) & Miller (L. A.). **Overwintering Habitats of the Onion Thrips, *Thrips tabaci* Lind. (Thysanoptera: Thripidae), in southwestern Ontario.**—*84th Rep. ent. Soc. Ont. 1953* pp. 82–86, 1 fig., 3 refs. [Guelph, Ont., 1954.]

Thrips tabaci Lind. is an important pest of onions in the marshlands of south-western Ontario. The adults migrate to them from other crops in the neighbourhood in mid-June and infestation is heavy from late June until harvest, usually in late August or September. Investigations were carried out in 1952–53 on the relative importance of various winter habitats of the thrips and of various crops in the proximity of onions. Samples were taken from six fields, ditch banks (grass sod) and a pile of onion waste, all within a quarter of a mile of an 11-acre onion field that was heavily infested, every two weeks from November 1952 to June 1953 and from August to December 1953. The samples from the fields consisted of the

green crowns of plants and soil from an area 7 ins. square to a depth of half an inch in winter and of plants 3–4 ins. high from April, when growth began. The technique and apparatus used to collect the thrips from the soil are described. It was found that the thrips overwintered principally in the adult stage and were particularly abundant in fields of red clover and lucerne but scarce in grass sod, onion waste and muck soil, which are therefore not considered sources of infestation. Oat stubble and winter wheat proved possible sources of infestation, both probably providing suitable winter habitats in the absence of lucerne and clover. Nymphal and adult populations were small in January and February and began to increase in March and April; the nymphal population increased markedly in May.

It was evident that the thrips dispersed to the nearest suitable overwintering site after the onion harvest, since a lucerne field 50 yards from the onion field supported a large overwintering population, whereas numbers in one a quarter of a mile away were negligible.

MORELAND (C. R.). **Some Aspects of the Ecology of the Clover Seed Weevil** *Miccotrogus picirostris* **(F.) (Coleoptera: Curculionidae).**—*84th Rep. ent. Soc. Ont. 1953* pp. 91–101, 4 figs., 9 refs. [Guelph, Ont., 1954.]

Factors influencing the migration of *Miccotrogus picirostris* (F.) into fields of alsike clover [*Trifolium hybridum*] in Ontario were investigated in 1951–53. The adults occur on the flowering parts of wild herbaceous plants from the beginning of May, and in early June they migrate into the clover fields, where they feed, mate and oviposit. Adults of the new generation emerge from the soil and leave the fields about mid-July, when the clover has been harvested, and evidently move into cover in hedgerows and pasture towards the end of August.

Daily sweeps with a net from 1st June to 14th July 1951 showed that the weevils appeared in a field of alsike clover on 4th June. Numbers rapidly increased to a maximum on 16th June, remained high until the end of the month and then slowly decreased. Similar results were obtained in 1953. In 1952, counts on frames coated with adhesive that were set up at the margins of fields showed a minor population peak on 7th June and another on 15th–16th June, confirming the observation that the weevils move into the fields by flying. Observations in 1951–52 showed that the number of hours of sunshine per day had no apparent effect on the weevil population, either on vegetation or in flight; that rainfall, unless light, disturbed the weevils, causing some to fall to the ground, and reduced populations; that relative humidity had no appreciable effect on the aerial population; and that the normal daily variations in temperature were of little importance in determining the population of adults in a particular place. Analysis of the numbers of insects taken on frames facing each of the cardinal points and the amount of wind to which each frame was exposed indicated that the weevils in flight were carried or aided by wind but that individuals sometimes flew against winds of moderate velocity; most were taken within 27 feet of ground level.

Some method of determining the best time to spray against the weevil is desirable. Making population assays by net sweeps or estimating the stage of development of the clover or of herbaceous or woody plants is difficult for growers, but it was observed that honey bees were working the clover the day after weevil movement began in 1951 and two days after the weevils began to increase in the field in 1953, and it is concluded that the presence of foraging bees could be used as an index.

Pengelly (D. H.). **Alfalfa Pollination in southern Ontario.**—*84th Rep. ent. Soc. Ont. 1953* pp. 101–118, 67 refs. [Guelph, Ont., 1954.]

The following is substantially the author's summary. The most important pollinators of lucerne in southern Ontario are wild bees of the genera *Bombus*, *Megachile* and *Andrena*. Small Halictid bees are of value under certain conditions, and a few of the larger species are important in some areas. A continuous supply of flowering plants throughout the growing season is necessary for maximum development of the bumble-bee colonies and maximum nest-building activities of the solitary forms. The commonest early-flowering plants in Ontario are the flowering trees and dandelions; the bloom period of the trees is short, and dandelions therefore provide most of the food for the early bees. *Megachile* emerges after mid-June and depends on *Hypericum perforatum*, *Potentilla recta* and other plants that flower late enough.

Communities of competing pollen sources often grow in close proximity to lucerne seed fields. The cutting of lucerne and red-clover hay crops when their bloom period coincides with that of the seed crop, and the cutting of communities of wild flowering plants at the same time, tends to restrict the available pollinators to the desired crop. The bloom period of lucerne can be timed to coincide with the peak of the pollinator population, which will, however, vary with the kinds of bees present. An appraisal of the species of wild pollinators in each district should be made before cropping practices are modified.

In general, the populations of wild bees are insufficient to pollinate the acreage of lucerne grown for seed production. Present farming practices do not favour an increase in bee numbers, and any attempt to bring this about will be well worth while. The introduction of different species of bees from other areas may be possible, but the re-establishment of native bees offers more promise.

Wenzl (H.) & Krexner (R.). **Versuche zur Bekämpfung der Vergilbungskrankheit der Rübe.** [Experiments in the Control of Yellows Disease of Beet.]—*Pflanzenschutzberichte* **12** pt. 7–8 pp. 105–128, 24 refs. Vienna, 1954. (With a Summary in English.)

The literature on the use of parathion and systemic insecticides to control Aphids on beet and thus to reduce infection with the beet-yellows virus is briefly reviewed, and an account is given of numerous experiments carried out in Austria, principally in 1953, in which Systox (diethyl 2-(ethylmercapto)ethyl thiophosphate) was applied to sugar beet at intervals of about a fortnight at nearly 0·3 pint per acre in dilute sprays against *Aphis* (*Doralis*) *fabae* Scop., almost the only Aphid present [*cf. R.A.E.*, A **42** 65].

The following is based on the authors' summary of the results. Spraying three times between late May and early July reduced the number of infected plants by half on an average and by two thirds at best when infection on untreated plants reached 7 per cent., and protection was greatest where infection was heaviest. In four out of five experiments, spraying once when apterae appeared on the plants prevented the development of large colonies of nymphs and alates during the entire period of 27–34 days during which infestation was increasing. Initial infestation, as measured by the number of plants infested by single alates, was not affected by spraying.

Beet sown in March or mid-May was less infected than that sown in April or early May, and infection was not reduced by watering the fields to promote growth.

ENTOMOLOGICAL LITERATURE

LARGEST STOCK IN THE WORLD

of Books, Serials and Pamphlets, in all Languages, relating to INSECTS, SPIDERS, MITES and TICKS.

CATALOGUES ON APPLICATION.

Liberal allowances in cash or exchange will be made for authors' reprints, and other works of entomological interest.

JOHN D. SHERMAN, JR., 132 Primrose Av., Mount Vernon, New York

THE ASSOCIATION OF ANTS WITH APHIDS AND COCCIDS

By G. E. J. NIXON, B.A.

(With a Foreword by W. J. Hall, C.M.G., M.C., D.Sc.)

A review of the literature with special reference to the rôle of the ants where the association is believed to be connected with the transmission of crop diseases.

Royal 8vo. 36 pp. Paper Covers. Price 5s. post free.

Orders should be addressed to *The Director, Commonwealth Institute of Entomology, 56, Queen's Gate, London, S.W.7.*

Les Cochenilles Paléarctiques de la Tribu des Diaspidini

par

A. S. BALACHOWSKY.

Chef de Service à l'Institut Pasteur, Paris.

Medium 8vo. 450 pp. 108 plates. Price £6 post free.

The scale-insects or Coccoidea are a very large super-family of Homoptera and include a considerable number of species that are pests of cultivated plants.

The family DIASPIDIDAE (armoured scales) is among the most important of the group. In a series of earlier publications (1948 to 1953), the author published monographs on some tribes of DIASPIDIDAE (ASPIDIOTINI, ODONASPIDINI, PARLATORINI), but the most important tribe, the DIASPIDINI, remained to be treated. This lacuna is filled to-day by the publication of the present work.

All DIASPIDINI belonging to the fauna of the Palearctic region (Europe, the Mediterranean basin, Egypt, North Africa, the Sahara, the Canaries, Madeira, the Azores, the Near East, the Middle East, central Asia and Siberia) are dealt with, not only from the morphological point of view but also with regard to their world distribution, behaviour, food-plants, habitat, economic importance and parasites. The book is illustrated by original plates relating to all the species dealt with.

Copies obtainable from **The Director, Commonwealth Institute of Entomology, 56, Queen's Gate, London, S.W.7.**

ZOOLOGICAL RECORD—PART INSECTA

The "Insecta" part of the "Zoological Record" is published annually at 30s. 6d. post free.

It contains as complete a record as possible of the entomological literature of the previous year and comprises three main sections:—

1. Titles of papers, arranged under authors;
2. an Index dealing with such subjects as Morphology, Physiology, Ecology, etc.;
3. a Systematic portion, which occupies about half the whole. This constitutes a classified index of all the new genera and species of insects that have been published during the year, as well as references to general papers on systematics.

Orders should be addressed to *The Director, Commonwealth Institute of Entomology, 56, Queen's Gate, London, S.W.7.*

Orders for the *complete* volume of the "Zoological Record" (as opposed to the "Insecta" part) should be sent to the Zoological Society of London, Regent's Park, London, N.W.1.

INDEX OF AUTHORS

ANON., 150.
Allen, W. R., 157.
Antonelli, C., 138.
Armstrong, T., 153.
Arthur, A. P., 134, 155.

Batt, R. F., 131.
Bawden, F. C., 129.
Begg, J. A., 158.
Bennett, S. H., 131.
Borg, A., 141.
Boyce, H. R., 155.
Boyce, K. E., 158.
Bradley, R. H. E., 133.
Buckland, C. T., 157.

Chatterji, S., 152.
Chaudhuri, R. P., 151.
Ciampolini, M., 138.
Connell, J. U., 130.
Coppel, H. C., 134, 155.

David, A. L., 152.
David, W. A. L., 130.
Dustan, G. G., 155.
Düzgüneş, Z., 148.

Edwards, C. A. T., 132.
Ext, W., 147.

Fjelddalen, J., 140.

Gardiner, B. O. C., 130.
Götz, B., 147.

Hamlyn, B. M. G., 129.
Hopf, H. S., 129.

Ibbotson, A., 132.

Jones, G. D. G., 130.

Keyder, S., 148.
King, J. E., 157.
Krexner, R., 160.
Kukovica, I., 156.
Kundan Lal, 150.

Lal Gupta, S. B., 151.

Marinari, A., 137.
Martin, Henri, 149.
Mathlein, R., 142.
Maw, M. G., 134.
Maybee, G. E., 156.
Melis, A., 135, 136, 137.
Miller, L. A., 158.
Monro, H. A. U., 157.
Moreland, C. R., 159.
Muldrew, J. A., 133.
Müller, F. P., 144.
Musgrave, A. J., 156.
Muthukrishnan, T. S., 152.

Narayanan, E. S., 150.
Nizamlioglu, K., 149.

Ossiannilsson, F., 141.

Patel, G. A., 153.
Patel, N. G., 153.
Pegazzano, F., 139.
Pengelly, D. H., 160.
Prasad, D., 152.

Rattan Lal, 151.
Reddy, D. B., 150.
Richardson, H. P., 157.
Rideout, D. W., 133.
Roesler, R., 144.
Röhrig, E., 145.

Samuel, C. K., 152.
Schmiedeberg, J., 148.
Sen, A. C., 152.

Thalenhorst, W., 142.
Thomas, W. D. E., 131.
Tunblad, B., 141.

von Rosen, H., 142.

Wasserburger, H. J., 148.
Watson, M. A., 129.
Wenzl, H., 160.
Wichmann, H. E., 145.
Wressell, H. B., 154.

Zocchi, R., 137, 139.

NOTICES

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Institute are requested to communicate with the Director. Authors of papers on economic entomology, whether published in entomological journals or not, are invited to send reprints to the Director for notice in the *Review*.

The Executive Council of the Commonwealth Agricultural Bureaux is a signatory to the Fair Copying Declaration, details of which can be obtained from the Royal Society, Burlington House, London, W.1.

The Annual Subscription, *in advance*, to a volume of the *Review* Series A (Agricultural) is 40s. post free; Series B (Medical and Veterinary), 20s. post free. Prices of Back Volumes on application.

Orders and Subscriptions should be sent to the Director, Commonwealth Institute of Entomology, 56, Queen's Gate, London, S.W.7, or through a bookseller.

CONTENTS

	PAGE
AFRICA, NORTH: *Euphyllura olivina* on Olive in Tripolitania	149
AUSTRIA: The Use of Systox against *Aphis fabae* on Beet	160
BRITAIN: The Bionomics and Control of *Otiorrhynchus clavipes* on Strawberry	132
CANADA: Resistance of *Pristiphora erichsonii* to a Parasite	133
CANADA: Effectiveness of Aphids as Vectors of Potato Virus Y	133
CANADA: Studies on two Dipterous Parasites of *Choristoneura fumiferana*	134
CANADA: Tests of new Acaricides in 1948–53	153
CANADA: Distribution and Status of *Pyrausta nubilalis* on Maize ...	154
CANADA: Effects of Insecticides on the Parasites of *Cydia molesta* ...	155
CANADA: Status of Parasites introduced against *Rhyacionia buoliana* ...	155
CANADA: The Release of introduced Parasites against *Psila rosae* ...	156
CANADA: The Bionomics and Control of *Torymus druparum*	157
CANADA: Soil Treatments against Wireworms in Tobacco Fields ...	158
CANADA: The Overwintering Habitats of *Thrips tabaci* in Ontario ...	158

[*Continued overleaf*

CONTENTS—*cont.*

PAGE

CANADA: The Migration of *Miccotrogus picirostris* to Alsike Clover ... 159
CANADA: Wild Bees pollinating Lucerne in Ontario 160
GERMANY: Fluctuations in the Numbers of Pine Sawflies 142
GERMANY: Observations on *Myzus ascalonicus* 144
GERMANY: Tetranychids on Fruit Trees and Vines in 1952 144
GERMANY: The Relation between *Ips typographus* and Ants 145
GERMANY: An Outbreak of *Cephaleia alpina* in Schleswig-Holstein ... 145
GERMANY: Treatments against *Byctiscus betulae* on Vines 147
GERMANY: *Bryobia praetiosa* entering a House 147
INDIA: Parasites of the Eggs of *Pyrilla* in Delhi 150
INDIA: Dusts against Cutworms in Potato Fields 151
INDIA: The Bionomics of a Syrphid predacious on Aphids 151
INDIA: A new Food-plant and Predators of *Dactylopius opuntiae* ... 152
INDIA: Varietal Resistance of Stored Sorghum to Pests 152
INDIA: Pests of Banana in Bihar 152
INDIA: The Bionomics of *Anaphothrips flavicinctus* on Wheat 153
ITALY: The Bionomics and Control of *Dacus oleae* 135, 136
ITALY: *Coraebus fasciatus* attacking Oaks 137
ITALY: Records of two Termites in Tuscany 137
ITALY: The Bionomics and Control of *Cleonus mendicus* on Beet ... 137, 138
ITALY: An Outbreak of *Theresimima ampelophaga* on Vines 139
ITALY: *Pseudaonidia paeoniae* on Ornamental Plants 139
JAPAN: The Presence of *Merodon equestris* and *Gnorimoschema operculella* 150
NORWAY: *Otiorrhynchus ovatus* on Strawberry and its Control 140
NORWAY: Cecidomyiids and Eriophyids on Fruit Trees and Bushes ... 140
SEYCHELLES: An Outbreak of *Aleurocanthus woglumi* on *Citrus* 150
SWEDEN: A first Record of *Myzus ascalonicus* 141
SWEDEN: *Ceuthorrhynchus syrites* damaging Seeds of *Camelina sativa* 141
SWEDEN: Eriophyids on Plum and Pear 141
SWEDEN: Methyl Bromide as a Fumigant in Flour-mills 142
SWEDEN: *Athalia glabricollis* attacking White Mustard 142
TURKEY: The Life-history of *Brevipalpus geisenheyneri* on Apple ... 148
TURKEY: *Aphytis proclia* parasitising *Pseudaulacaspis pentagona* on Mulberry 148
TURKEY: *Tanymecus dilaticollis* injuring Fruit Trees 149
TURKEY: New Parasite Records 149
U.S.A.: A first Record of *Tetranychus tiliarius* 150
Distribution of Viruses in Leaves and its Effect 129
Inhibition of Acetylesterases of Locust Nerve Cord by organic Phosphates 129
Tests of Systemic Insecticides on *Phaedon cochleariae* 130
The Toxicity of Organic Insecticides to Honey Bees 130
Absorption, Translocation and Breakdown of Schradan applied to Leaves 131
The acute Toxicity of BHC to Man 148
Effects of short Exposures to low Temperatures on *Calandra oryzae* ... 150
Rapid Insecticide Tests with Aphids 156
The Measurement of Methyl-bromide Concentrations in Ship Fumigation 157

Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE
by The Eastern Press, Ltd., London and Reading.

(1814) Wt. P8522/3895 5/55 E.P. Ltd. Gp. 566. [A]